ASSOCIATION DES FABRICANTS D'ENCRES D'IMPRIMERIE

Good printing practices for manufacturers of paper and board materials and articles intended to come into contact with foodstuffs.

Association "MCAS
Materials for foodstuffs
packaging and health
(Paper and board
chain)

AFEI
Association of Printing Ink
Manufacturers

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Contents

Foreword:

This document has been written by the French associations Club MCAS : Materials for foodstuff packaging and health (paper and board chain) and the Association of Printing Ink Manufacturers (AFEI) based on current knowledge.

1. Objective:

To provide the manufacturers with good manufacturing practices during the application of inks and overprint varnishes so that they take all precautions to comply with the GMP regulation (EC) 2023/2006 (to limit the set-off phenomenon) and regulation (EC) 1935/2004.

The recommendations are set out based on the identification of the requirements, the identified risks, ink type and the printing processes.

These good manufacturing practices do not apply to products made from tissue paper.

2. Preamble

This document is limited to the printing process in accordance with the criteria in appendix 1 of the European regulation (EC) 2023/2006 and does not cover the other general requirements linked to the GMP regulation (quality management).

This document does not provide exemption from the legal regulations. All the information has been grouped together in full knowledge of the facts. The state of art, the exactitude, the completeness or the quality of the information is not guaranteed by the associations.
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The statutory context is the following:

- **European Union**

    - **European regulation n° 1935/2004**

The framework regulation specifying the general requirements for food contact materials and the authorisation procedure for new substances.
Article 3 stipulates that the materials must be manufactured in accordance with the good manufacturing practices so that, under the normal or foreseeable conditions of use the material does not pose a health risk; bring about an unacceptable change in the composition of the food; or to alter the organoleptic properties of the packed food.

    - **European regulation n° 2023/2006**

This regulation stipulates the good manufacturing practices mentioned in the framework regulation: Quality Assurance System, Quality Control System, Documentation and an Appendix of requirements for the printing process and printed products.

- **France**

    - **French decree n° 2007-766**

Sanction decree, repealing to a large extent the French framework decree number 92-631 (Materials and articles intended to come into contact with foodstuffs for feedstuffs), last modified by the French decree n° 2008-1469, indicating the content of the authorisation files for chemical substances and restating the requirement of a declaration of conformity to accompany the materials and articles.

    - **Avis du Conseil Supérieur d'Hygiène Publique de France du 07/11/1995 for inks and varnishes intended to come into contact with food.**

Specifies restrictions for colorants, solvents, technological additives, purity specifications and requests data demonstrating genotoxic safety.

3. Definitions

Primary packaging: sales packaging or primary packaging, i. e. packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase;
Primary packaging can consist of several wrappings, which are easily separable. The internal component is in direct contact with the food.
The barrier properties of the internal and external components must be studied in addition to the transfer potential into the food through set-off or gaseous phase transfer during the converting process.

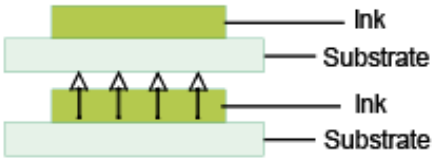
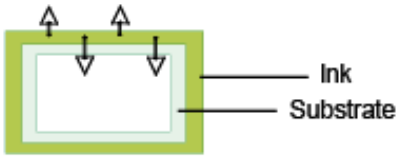
Secondary packaging: grouped packaging or secondary packaging, i. e. packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics;
It does not generally offer any functional protection for the food.
The primary packaging must, alone, ensure the functional protection of the food.

Tertiary packaging: transport packaging or tertiary packaging, i. e. packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packaging in order to prevent physical handling and transport damage. Transport packaging does not include road, rail, ship and air containers;

Migration: The migration of a constituent is the transfer of this constituent into food from the packaging material. The specific regulations give migration limits for some substances.

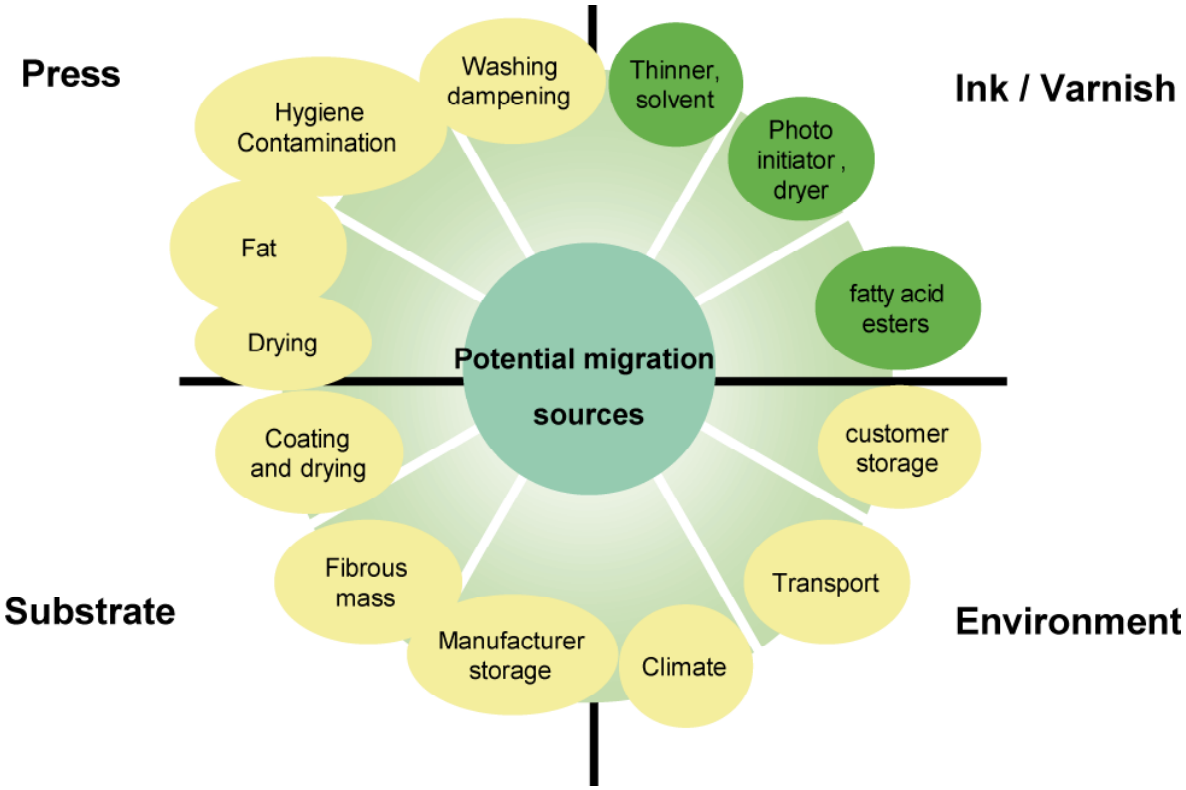
How does migration occur?

The possible sources of contamination during the manufacture of the packaging (printing, conversion, handling, storage) are identified in the diagram below.

1.	**Diffusion** Through the substrate onto the back of the printed material (thin film)	
2.	**Contact** Transfer of the printing on the back of the sheet stored in piles or on reels during drying	
3.	**Evaporation** of constituents during cooking in the packaging	
4.	**Condensation Extraction** of critical constituents during cooking / sterilisation	

4. Analysis of requirements

The packaging manufacturer has to obtain from their customer information about the food and the packaging system in order to determine the type of contact and in order to carry out the risks analysis detailed below.

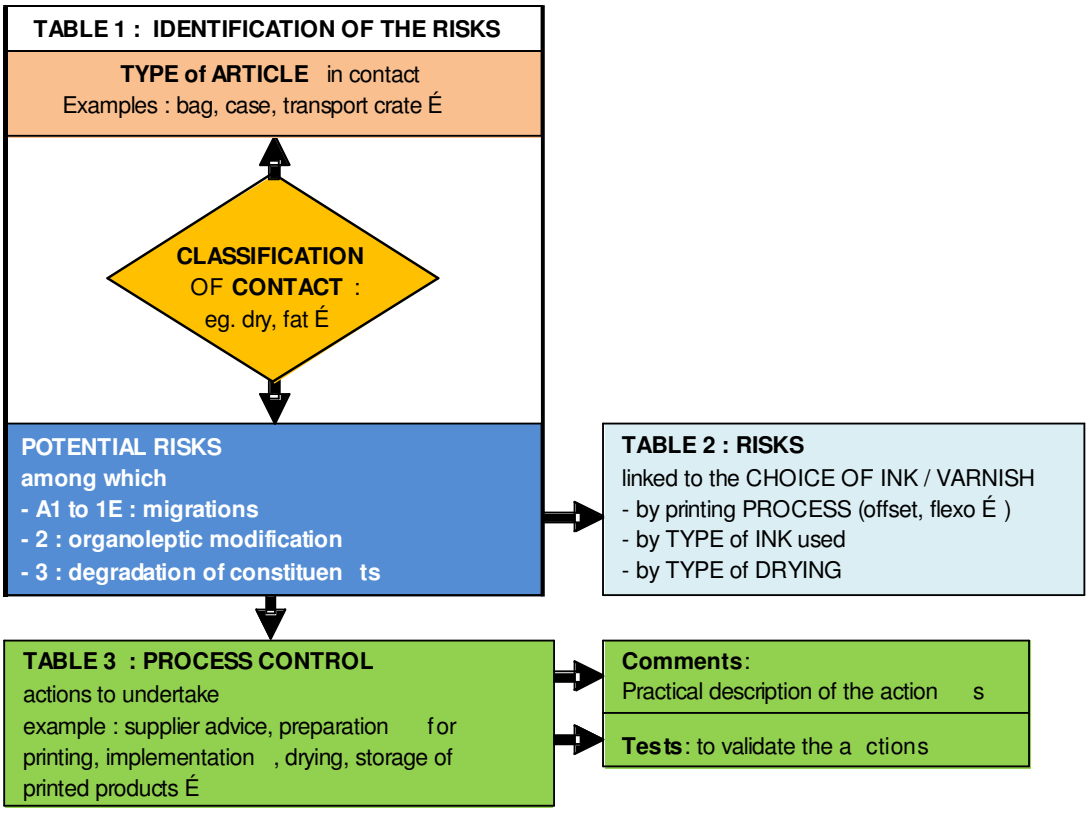


5. Analysis of the potential hazards, risks assessment and recommendations

The risks analysis is based around two approaches.

- Firstly hazards identification depending on the type of packaging and type of food (table n° 1: risks identification by type of packaging).
- Secondly: hazards identification from the printing process and ink type (table n° 2: risks linked to the choice of ink/varnish).
  Recommendations to control the process are defined in table n° 3: process control.

The following diagram presents the interconnectivity of the three tables.



5.1. **Table 1: Identification of the risks**

Type of packaging	Type of food	Applications	Specific ink related risks with regard to the food
Flexible packaging	Dry	Packaging papers for retail sales products (bread, dry foods in bulk)	**1A, 1B, 1C, 2**
	Moist or fatty	Packaging papers for fresh products (cheeses and sliced meats) small boxes for cakes and sweets	**1A, 1B, 1C, 1D, 2,**
Rigid packaging.	Dry, shelled, peeled and washed fruit and vegetable	folding boxes for rice, cereals, sugars Corrugated cardboard boxes, flat cardboard cartons, single ply paper bags	**1A, 1B, 1C, 2**
	Moist or fatty	Chocolate, confectionary	**1A, 1B, 1C, 1D, 2**
Packaging with a barrier tlayer in contact with the food.	Dry	folding boxes for packaging biscuits, cereals, dry cereals, frozen products (frozen and defrosted outside the packaging)	**1A (if insufficient barrier), 1C, 2 (if insufficient barrier)**
	Moist or fatty	Frozen goods (frozen and/or defrosted in the packaging). Corrugated cardboard boxes with a coated inner liner for packaging moist products, multipli bags with barrier, cups for liquids	
Packaging with pre-packed food in a film barrier pouch (no risk of ink transfer).	Dry	folding boxes for packaging biscuits, cereals, dried products, frozen products (frozen and defrosted outside the packaging)	**1A (if insufficient barrier), 2 (if insufficient barrier)**
	Moist or fatty	Frozen products (frozen and/or defrosted out of the packaging).	
Packaging intended for use in microwave ovens	Moist or fatty	Chicken bags, boxes of frozen products with susceptor (frozen chips)	**1A, 1B, 1C, 1D, 1E, 2, 3**
Packaging intended for oven cooking.	Moist or fatty	Cartons trays for frozen ready meals	
Laminate packaging for liquids.	Moist or fatty	Cartons for liquids	**1A, 1B, 1C, 2**

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1. Migration of some ink constituents:

   1A. By volatile phase.
   1B. Through the substrate.
   1C. Risk of migration via ink set off onto the food-contact side after printing (if the material is printed on sheet or rolls before manufacturing the packaging).
   1D. By solubilisation, in contact with the fats or moisture of the food (bleeding).
   1E. Migration by steam distillation while cooking, pastry making or sterilisation.

2. Modification of taste and smell.
3. Deterioration resulting from microwaves and/or the temperature of some ink constituents and risk of migration by gaseous phase.

Comments: Modification of the organoleptic characteristics of the foods.

The packaging may induce a modification of smell and taste by diffusion of volatile products either into the internal atmosphere of the packaging or into the food itself.

The deterioration process is generally caused, either by a chemical, biochemical or biological deterioration, accelerated by the presence of air, light, or microorganisms, or by an increase in temperature or by the creation of an exchange condition with the packaging. It is the latter deterioration which we can quantify.

Chromatographic separation and spectroscopic analysis techniques can be used in combination with sensory tests carried out by trained panels, to identify potential volatile products which are likely to modify the taste and smell.

A global analysis of the product rate extract is not sufficient to predict the eventual modification of taste or smell. For example, the action of some aldehydes is far more critical at 2 mg/m^2 than ethyl acetate is at 15 mg/m^2. The main substances likely to alter these characteristics are:

- light alcohols
- light hydrocarbons, ketones, acetate, esters…
- aldehydes corresponding to the deterioration of fatty products (siccative oil in inks for example, the decomposition of fatty acid esters in fatty foods and packagings).
- Heavy hydrocarbons
- Photoinitiators in inks and varnishes drying with UV radiation.

In the case of rotogravure and flexographic inks, the light solvents retained in the printed product constitute the principal cause (acetate, alcohols, esters, ketones, light hydrocarbons) of smell and taste modification. The residual quantity responsible for this modification will depend above all on the composition of the ink and the drying conditions.
In the case of conventional offset inks, it is particularly the oxidation products which are responsible. They come from either the primary materials, or in the products formed during the oxypolymerisation process (aldehydes and ketones). The use, reduction and the selection of these materials are possibilities for improvement.
The inks drying by UV radiation are influenced by either the photoinitiators remaining in the ink film after drying, or by impurities in the acrylic binders resulting from organic synthesis. A better purification of the binders as well as a selection of photoinitiators are the possible areas of improvement.
Finally, take into account the presence of solvents and glue plasticisers as well as all the additives used during the manufacture of the printed product (press washing agent for printing, additive for fountain solutions), thus understood as the conditions for packaging the food (cold or hot).

5.2. **Table 2: Risks linked to the choice of ink/varnish**

Type of inks and varnishes	Type of drying	Processes		Specific risks of inks and varnishes with regard to food
Water based	Diffusion and evaporation	Flexography	1A	Migration of residual solvent or volatile additives by: - retention of the resin - insufficient evaporation
			1C	Risk of ink set off to the food-contact surface if there is a large coverage rate and insufficient drying (the pressure and contact temperature are key elements)
			2	Modification of taste and smell by migration into the food of gaseous phases or liquids constituting the ink once dried
Organic solvent	Diffusion and evaporation	Flexography Ink jet silk screen printing	1A	Migration of residual solvent or volatile additives by: - retention of the resin - insufficient evaporation
			1C	Risk of ink set off to the food-contact surface if there is a large coverage rate and insufficient drying (the pressure and contact temperature are key elements)
			2	Modification of taste and smell by migration into the food of gaseous phases or liquids constituting the ink once dried
Mineral oil based	Diffusion and evaporation Diffusion and oxypolymerisation	Roto offset with hot air drying Sheetfed offset	1A	Migration of volatile phases resulting in the decomposition of vegetable oils
			1B	Migration of the mineral oil through the substrate over time (temperature and porosity of the substratum catalyse the phenomenon)
			1C	Risk of ink set off to the food-contact surface after printing by contact (pressure and contact temperature are key elements)
			2	Modification of taste and smell by migration into the food of gaseous phases or liquids constituting the ink once dried

Type of inks and varnishes	Type of drying	Processes		Specific risks of inks and varnishes with regard to food
Vegetable oil inks	Diffusion and oxypolymerisation	Sheet offset	1A	Migration of volatile phases resulting in the decomposition of vegetable oils
			1C	Risk of ink set off to the food-contact surface after printing by contact (pressure and contact temperature are key elements)
			2	Modification of the smell and taste of foods under gaseous phases or liquids of the constituents of the ink resulting from drying
Acrylates UV Inks	Polymerisation under UV rays with photoinitiator, diffusion	Flexography Sheetfed and roto offset, silk screen ink	1A	Migration of volatile phases resulting from an incomplete polymerisation or photoinitiators (particularly when the ink was deposited on the absorbent substrate)
			1B	Risk of migration of monomers and photoinitiators from the ink through the substrate for the inks “low migration”
			1C	Risk of ink set off to the food-contact after contact printing (the pressure and the contact temperature are key elements)
			2	Modification of the smell and taste of foods from the ink constituents resulting from the decomposition during drying
Acrylates EBC inks	Polymerisation under electron been without photoinitiator, diffusion	Roto offset	1A	Migration of volatile substances resulting from an incomplete polymerisation or photoinitiators (particularly when the ink was deposited on the absorbent substrate)
			1B	Risk of migration of monomers and photoinitiators from the ink through the substrate for the inks not weak migration
			1C	Risk of ink set off of the food-contact surface after contact printing (the pressure and the contact temperature are key elements)
			2	Modification of the smell and taste of foods from the ink constituents resulting from the decomposition during drying

Specific case of non impact digital printing:

In addition to the traditional printing processes the following processes can be identified:

- laser printing done with solid pigment toners coated with styrene/acrylate resin.
- ink jet printing often done with inks made from dye or colorant solubilised or dispersed in styrene/butadiene resins; or from cellulose derivatives in ketonic, acetate, alcohol or glycol ether medium.

Although currently used in a small quantity these products can modify the organoleptic properties of food, therefore the drying processes must be validated and only substances intended for food product packaging must be used in this application method.

Selection of additives added at the time of use:

An additive is an agent added to the ink enabling the modification of specific properties of the ink , modifying the others as little as possible.
The additives are included in the inks and varnishes for printing. For application to packaging for foodstuffs, we advise against the addition of any such constituent if it is not explicitly mentioned by the supplier.
What are the additives which can be found in an ink or varnish :

- Plasticisers agent
- Retardant agent for drying agents rotogravure, flexographic and silk screen printing inks
- Drying initiator: dryers for conventional offset inks and photoinitiators for drying products by UV radiation.
- Surface modifying agents (of the ink or varnish film): mating agent, waxes, anti-set off agents… (silica wax, starch…)
- Agent modifying the flow properties: gelling agents, anti-tack agent: (bentonites, carbonates, organic derivates, polyamides…)
- Agent modifying the water/ink emulsification in offset printing, the spraying to the substrates: surface active agents (silicon, alcohol, amines,…)
- Preservatives particularly for water inks.

5.3. **Table 3: Process Control**

Specific risks of inks and papers/cartons with regard to food		Control of the printing process	Recommendations
1A	Migration of certain ink constituents by volatile phase	Quantity of ink and varnish	- Minimise the coverage of ink at the design stage - Retardant the ink load - Use an appropriate volume of the anilox roll
		Drying of the ink and varnish	- Offset, minimise the quantity of fountain solution and stabilise the pH over 4.5 - Control the efficiency of the dryer by tests on the printed material - Do not exceed a stack temperature of 40°C
		Ventilation after printing	- Avoid immediate confinement - Allow for a sufficient delay before use
1B	Migration of some ink constituents through the substrate	Choice of inks and varnishes	- Use conventional offset inks or UV or EB inks called “low migration” see document EuPIA/AFEI[1] - Use specially formulated solvent or water based inks designed to be applied to packaging for foodstuffs
		Drying of the ink and varnish	- Control the efficiency of the dryer

[1] CLIENT INFORMATION NOTE concerning the use of sheet offset inks /varnishes (fixing and/or drying by oxidation, or UV/EB radiation) for the manufacture of food packaging – 5 Februrary 2009

1C	Migration of some ink constituents after transferring the ink onto the food-contact surface after printing (if the material is sheet or reels printed before manufacturing the packaging)	Choice of inks and varnishes	- Use conventional offset or UV or EB inks called “low migration” see document EuPIA/AFEI[1] - Use specially formulated solvent or water based inks designed to be applied to packaging for foodstuffs
		In line Varnishing	- Protect the print until the ink is completely dryed
		Drying of the ink and varnish	- Control the efficiency of the dryer
		Minimise: - the pressure in the stacks - the reel hardness	- Control and minimise the height of the stacks
1D	Migration of some ink constituents by solubilisation in contact with fats or moisture of the food (discharge)	Choice of substrate	- Use a substrate barrier for fatty and moist products (a Corona treatment enables the ink to better adhere to the polyethylene coated substrate)
		ink Selection	- Use inks respecting the aforementioned criteria and with pigments resistant to the food constituents
		Drying of the ink and varnish	- Control the efficiency of the dryer

1E	Migration of some ink constituents through steam distillation while cooking, pastry making or sterilising.	Quantity of ink	- Minimise the coverage of ink at the design stage - Minimise the printed film weight
		ink selection	- Use ink ranges which are resistant to the required temperature (resin pigments, solvent and solid additives) - A trial test is strongly recommended with the presence of the suppliers and customers validation
		Drying of the ink and varnish	- Control the efficiency of the dryer
		Ventilate after printing	- Avoid immediate containment - Allow for a sufficient time before use
2	Modification of the taste and smell	Selection of primary materials	Use according to the ranges of inks “low smell” and/or “low migration” by asking advice (specifications) from the suppliers
		Control the dampness by offset	- Limit the use of isopropyl alcohol in the dampening
		Ventilate after printing	- Avoid immediate containment - Allow for a sufficient time before use
3	Deterioration of certain ink constituents and the risk of migration by volatile phase	inks and varnishes selection	- Use ink ranges which are resistant to the required temperature (resin pigments, solvent and solid additives). A trial test is strongly recommended incorporating the full supply chain - Use products as delivered by the supplier avoiding the addition of additives - Avoid high ink coverage and do not use inks reticulated by ultraviolet rays for application in the microwave - Avoid supplying printed packaging
		Drying of the ink and varnish	- Control the efficiency of the dryer
		Ventilate after printing	- Avoid immediate containment - Allow for a sufficient time before use

5.3.1. Precautions for the inks and varnishes selection for specific applications

Risk 1D: solubilisation in contact with fats or moisture from the food (bleeding)

Certain raw materials included in printing inks are soluble in some chemicals or atmospheric agents. It can result in an extraction of these elements from the ink film (primary matrix) and fixation onto a secondary matrix (food among others, or dissolve the material in the residual water included in the packaging).
Standardised tests enable the behaviour of an ink dried and applied to foil with regard to fats among others to be predicted (ISO standard 2842 – resistance to oils and fats).

Risk 1E: Migration through steam distillation while cooking, pastry making or sterilisation

The resistance to heat from possible steam distillation by the combined action of the temperature and the water vapour present is to be applied to both the pigment and the carrying medium. In effect, all organic compounds (printing inks raw materials have their own decomposition limits depending on time/temperature transformation curve). After exceeding these specific limits, the products may deteriorate through decomposition. Due to this reason, it is stated on the ink suppliers' technical data sheets: the fastness obtained by the type and colour of ink, once the ink is dried and on the substrate of application. These temperatures should generally not exceed 190°C.
Note: resistance to sterilisation is expressed by the standard ISO 5736 – resistance to sterilisation

Risk 3: Deterioration resulting from microwaves and/or the temperature of certain ink constituents, and the risk of migration by volatile phase.

The deterioration of certain ink constituents which can occur when the temperature limit is reached, or when there is steam distillation of certain constituents (solubilisation of an alcohol in water…), generally leads to decomposition evidenced by the creation of llower molecular weight compounds, able to migrate more quickly into the confined atmosphere of the packaging which may result in sensory modifications to the food.

5.3.2. Precautions to control ink deposition

- **Minimise the risks at the design stage**

Identify a compromise between the applied ink/varnish film weight and the visual effect desired visual effect, taking into account that the probability of migration is proportional to the quantity of ink/varnish used on the paper or carton.
In this regard, the lowest possible film weight is desirable, - a compromise between the quantity of varnish used and the glossy and mechanical strength characteristics.
For the four-colour process, the technique of under colour removal in photogravure is highly recommended. It consists of replacing part of the cyan/magenta and yellow with black if the proportions allow.

Multiple overprinting must be avoided as far as possible.

- **Minimise the ink film weight**

The printer or converter should try to minimise the ink film thickness layer for the approved printing proof by using a densitometric instrumental control (for the four-colour process, search of standard values and the validation of the printing process in accordance with the standard ISO 12647 parts 1 to 8) or colorimetric for spot shades. Instrumental control enables the validation of the approved printing proof with regards to the proof submitted and avoids shade drift throughout the printing.

- **Use of special colours and fulfilment of ink mixes**

With regards to spot colours (only colour printed in full tone), its intensity must be studied in order to develop the visual effect.
The mixing of inks at the time of use must be fulfilled by taking into account the advice from the inks suppliers, particularly with regards to the ink load necessary to obtain the tint and its composition, with respect to the material used in cleaning of the mixing equipment (use of cleaning product recommended by the ink and varnish suppliers).
For traceability reasons, the numbers of the lots used must appear on a manufacture order stating the number of printing carried out and, if possible the quantities used.

5.3.3. Minimisation of the quantity and quality of fountain solution in offset

The offset process distributes a significant volume of fountain solution onto the paper/carton. The quantity of fountain solution used should be minimised as it can reduce the drying speed of the ink Moreover, its pH must not be below 4.5 and must be stabilised in order to not risk dissolving the drier of the conventional ink offset.

Qualitatively, isopropyl alcohol must be avoided as it has a negative impact on the organoleptic properties of the food and can become embedded in the foil capillaries. Finally, the composition of the fountain solution must be studied for this application by asking advice from the ink manufacturer.

5.3.4. Control of the pH of papers/cartons

The pH can have an impact on the pigments with acidic or alkaline constituents leading to decomposition on the non neutral substrates.
Moreover, a substrate with a surface which is too acidic risks causing a delay in the drying of the conventional inks offset through deterioration of the siccative.

5.3.5. Choice of anilox

a. For the ink groups:

The choice of anilox is linked to the substrate (particularly coated or uncoated) as well as the type and complexity of the printing. An example for non coated paper, an anilox enabling a higher volume of ink and which will have a lower screen ruling. However, in the case of coated paper, the volume of ink transferred will be lower and an anilox with a higher ruling will be used.

b. For the varnish groups:

According to the state of the surface and the porosity of the receiving substrate, the composition of the varnish is adapted in order to produce the required characteristics of the dry film: protection of the print (mechanical and chemical), level of gloss and in certain cases some specific characteristics (non-slip...). The anilox, ensures, by its volume, the amount of transfer of varnish onto the receiving substrate. Too high volume leads to an excess of varnish which must be dried. As an example, for an application onto coated paper/carton, the scale of volume is from 9 to 13cm^3 according to the roughness of the surface.
This anilox must be cleaned regularly in order not to reduce its useful volume.

5.3.6. Control of the drying efficiency

The drying of an ink or varnish consists of converting the wet ink product into a dry film, adhering to the substrate once applied. The properties of the dry film thus formed enable the development of glossy properties, mechanical properties (resistance to deformation and cuttings) and characteristics of insolubility to chemical agents.
The drying generally combines several physical or chemical operations modifying the composition of the ink or varnish.

Physical operations: selective filtration into the paper/carton of certain low molecular weight parts of the ink or varnish (solvent, thinner...), evaporation of low molecular weight parts in a dryer when the temperature and ventilation allow it, or by coalescence.
Chemical reactions: oxypolymerisation of certain fatty acid esters in the case of conventional offset inks and varnishes or radical polymerisation in the case of inks or varnishes dried under ultraviolet radiation or by electron beams.

In all cases, ensure the drying efficiency before any manipulation of the print, through appropriate tests recommended by the manufacturers of the inks and varnishes, or usually used in the profession (deletion, rubbing, adhesion etc...see paragraph 6).

Finally, after drying, the temperature of the fresh print should in all cases be below 40°C. As manychemical drying reactions are exothermic, the temperature of the stack or the reel can increase facilitating the migration of certain constituents of the ink and varnish.

In the case of drying under ultraviolet radiation or by electron beam, complementary tests on the print can verify if the polymerisation reaction has been efficient:

- the verification of the mechanical resistance (see paragraph 6). – In accordance with the same principle, a test using an adhesive tape enables the verification of whether it peels off with or without the deterioration of the printing.
- Another method based on the rubbing of a cloth soaked in methyl ethyl ketone (MEK) enables the verification of whether the surface of the print is sufficiently resistant to the chemical aggression of this solvent. Generally, a sufficiently resistant ink film resists 50 rubs back and forth with the soaked cloth.

- The detection of non reacted double bonds present in the ink film or varnish is a method of detecting insufficient polymerisation. The method consists of depositing a drop of potassium permanganate solution (1g per litre of water) onto the ink film or varnish. After a few minutes of contact (generally 2mins), if the violet colour of the test liquid does

not deteriorate the film is sufficiently dry. However, if it turns brown, a drying deficiency is seen (the potassium permanganate has reacted with the double bonds still present).

5.3.7. Control of the dryer efficiency

The efficiency of the dryers is a critical parameter which must be verified periodically and the verification must be jointly signed.

- **Verification of the ultraviolet dryers**

The permanganate test enables the verification of the efficiency of the dryer based on the speed of the printing.
These tests should be carried out at the same machine speed and for each dryer. A periodic verification verifies whether or not there is a drift in the efficiency of the dryer.
Ensuring a periodic cleaning of the dryer and respecting the life span of the lamps is recommended.

- **Verification of infrared and hot air dryers**

To verify the efficiency of a dryer of this type, an assessment of residual humidity must be carried out for the printed material before and after the dryer.
The dryer must be sufficiently efficient to extract the residual water in the print, without exceeding a temperature of 40°C on the printed material. It is the standard air/heat relationships, IR ramp, which determines the drying capacity.
An acrylic varnish can be used for the purpose of the test. The time after which the print should be tacky to touch must not exceed a maximum of 1min 30 secs. To carry out this test, take sheet printed with varnish from the machine and touch the print, control the residual tack which should progressively disappears with time.

5.3.8. Cleaning the printing stations

If there is a switch between food contact and non food contact printing, it is recommended that the printing stations are rigorously cleaned using special products recommended by the ink manufacturers, ensuring there is no residual trace of cleaner on the ink unit. The rubber rolls can retain a fraction of these cleaning products or certain ink constituents, redistributing them later in the ink during printing.
With regards to the offset, the dampening system and the pipes must also be emptied and cleaned before tackling this type of printing (if the previous printing was not using inks designed for food contact packaging) .

5.3.9. Storage

Store the pallet or reels of non printed and printed papers in well-ventilated premises, in normal temperature and humidity conditions (maximum 30°C – maximum 70%RH).
A 48 hour wait is recommended before using the prints made by conventional offset.
The use of the floor cleaning products which can have a harmful effect on the smell and taste as well as on the migration tests should be carefully controlled.

5.3.10. Transport of the printed materials

The transport of the printed materials before use must be done under hygienic conditions and respect the possibilities of contamination with regard to the taste and smells which can eventually be transmitted to the food. Protection is therefore necessary for the transport, once the packaging is completely dried.

6. Standardised tests

6.1. Table of standards used to verify the resistance of a dried print

ISO standards	Nature of the rule
2834	Normal printing enabling the following solidity tests to be carried out
2836	Resistance to water
2837	Resistance to solvents
2841	Resistance to cheeses
2842	Resistance to oils and fats
2844	Resistance to spices
ISO 5736	Resistance to sterilisation

6.2. Standards relating to graphics industry

ISO standards 12647: Process control for the production of half-tone colour separations, proof and production prints –

- Part: Parameters and measurement methods
- Part 2: Offset lithographic processes. Control of the preparation process for selecting halftone colours, tests and prints
- Part 3: Offset prints without dryer on newsprint
- Part 4: Gravure process
- Part 5: Serigraphy
- Part 6: Flexographic process
- Part 7: Test process working directly from numeric data

6.3. Verification of the mechanical properties

A finger test, which consists of using the thumb to apply pressure onto the print coming out of the machine can be used to check whether or not there is a deterioration in the print and if the start of the drying phase is underway by changes in the imprint left by the test print. A dry ink or varnish must resist this test.

The mechanical properties are supplied by the carrying medium, as aresult of the effectiveness of coating of the pigment by the carrying medium and via the effect of certain additives. These properties can be broken down into several elements: adhesion, hardness, slip characteristics, rub resistance, flexibility, elasticity.

- **Adhesion**, or more specifically the adhesive force of the ink film/substrate is the result of their interaction. If this force is equal to or greater than the internal

cohesion of the ink film or foil, there is homogeneity of the property and good adhesion. The penetration of certain components of the ink into the paper or carton pores gives a positive effect on adhesion.

Adhesion is verified in a simple manner by testing with adhesive tape for the inks and varnishes drying under ultraviolet rays or water based or solvent inks printed on paper/carton with low porosity. A band of adhesive tape is stuck on the printed substrate then torn off. The quantity of ink removed off by the tape (in other words delaminated) evaluates the adhesion of the ink film on the substrate. The adhesive tape which is usually recommended is the adhesive tape reference 683 from 3M.

- **The internal mechanical properties of the ink film** depend on the formation of a cohesive matrix of the ink film during drying trapping the pigment. The resistance to rubbing, scratching and the hardness of the ink film depends on the degree of polymerisation in the ink and the tendency of the dried ink to delaminate. This can easily be tested by rubbing two prints together whilst exerting some pressure. If it is difficult to separate the prints or if the print is damaged, the mechanical properties are bad and are generally caused by insufficient drying.

- **The slip characteristic** corresponds to an aspect of surface. Microcrystalline waxes are generally deposited (as happens on the floors with the slippery floor cleaners) in order to modify slip. The waxes must be present at the surface of the print in order to produce an effect. By rubbing two prints together without pressure the slip characteristics can be evaluated. When they slide without any problem, there is high slip.

6.4. **Verification of the pH of paper/carton supports**

The measure of the pH of the surface of papers/cartons is done with a plate reference electrode and a combination measure electrode. By placing this electrode into a drop of neutral water which has been dropped on the substrate, the development of the pH can be monitored over time. The pH which develops is the result of the quality and the quantity of certain salts present beneath the surface of the substrate.

Glossary

Cleavage: sliding of the layers over one another by the action of a shear stress in the plan.

Coalescence: Phenomenon which leads to the formation of a continuous film, by attracting one polymer to another in the evaporation phase of water. The efficiency of the attraction can be increased by the addition of coalescence agents.

Contaminant: Any biological (including microbiological) or chemical agent, any foreign matter or any substance not intentionally added which can compromise the safety or adequacy

CSHPF: Acronym for an old French authority called the Supreme Council on Public Hygiene in France.

Fatty acid ester: Fatty acids from esterified animal and vegetable fats and oils with linear, aliphatic, monohydric, saturated or non saturated and primary alcohols

EuPIA: European Printing Ink Association member of CEPE (European Council of producers and importers of paints, printing inks and artists' colours)

GMP: Good Manufacturing Practices

Print stations: Part of the machine receiving the ink.

Low migration: the products called "Low Migration" are products made with selected constituents in order to minimise both the risk of migration through the support and the transfer from the external printed surface onto the surface in contact with the food while stored in stack or bobbins.

EN Standard: European Standard

Photoinitiator: Highly absorbent photochemical initiator in the UV domain. The energy from UV rays breaks them down into free radicals which initiate the process of the polymerisation of the ink.

Set-off: Transfer from the printed surface which is not properly dry, to the non printed surface intended to come into contact with the food during storage in stacks or on bobbins. When it is visible, it is commonly called maculation.

ASSOCIATION DES FABRICANTS D'ENCRES D'IMPRIMERIE

http://www.afei.fr/

Tél. : 02.31.83.76.47
Fax : 02.31.78.62.49

mail@afei.fr

http://www.club-mcas.fr/

Tél. : 01.53.89.24.90
Fax : 01.45.62.45.27

club-mcas@wanadoo.fr