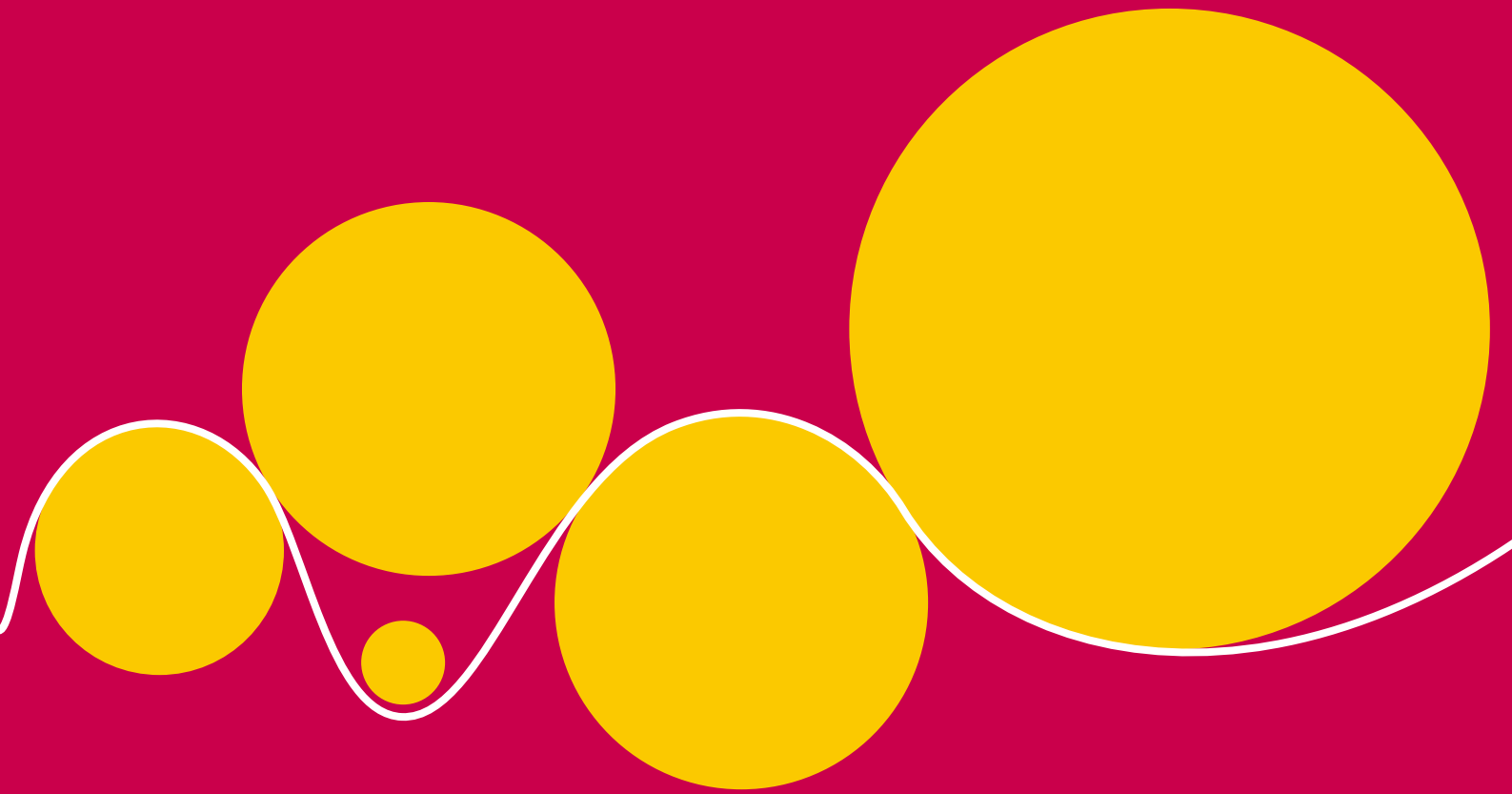


thermoscript **perfectly printed**

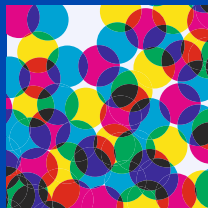
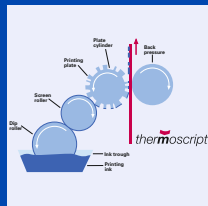
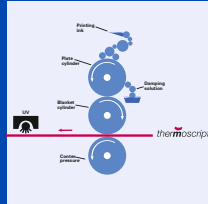


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*thermoscript –
perfectly printed*

- > Introduction
- > Surface finish
of thermal paper
- > Offset printing
- > UV inks
- > Flexographic printing
- > Contact
- > Ink manufacturers



thermoscript – perfectly printed

***“Our thermoscript grades
produce great contrast and
outstanding printing results
that even amaze the experts.***

***But there is always room for
improvement. That is why we
have taken on an experienced
printer to test our papers
under extreme conditions,
which frequently go beyond
even what the market
demands.***

*Dr Bernd Gerecht,
General Manager
Marketing & Strategy
Mitsubishi HiTec Paper Flensburg*

Thermal paper is conquering the market. Its use in fax machines is now only one of many possible applications. Printed thermal paper is a constant presence, be it in the form of admission tickets, lottery tickets, ATBs, parking tickets or bank statements.

The printing is what gives the final product its individual character. With good-quality printing, the products make excellent advertising vehicles. This advertising can be used in turn to offset the cost of the paper, leading to new marketing initiatives. Certain products, such as admission tickets, have to satisfy special requirements and are often in the nature of a souvenir. In such cases high-quality printing is particularly important.

Mitsubishi HiTec Paper manufactures and sells thermal paper with great success worldwide. It therefore goes without saying that we are experts not only in manufacturing, but also in printing on, our *thermoscript* papers. Working together with printers and press manufacturers, we subject our papers to extensive testing and check out all the technical aspects of printing.

After all, we have succeeded only if our paper produces first-rate printing results and the end-user is completely happy.



The surface finish of thermal paper

Owing to the demands made on it by thermal printers, the surface of thermal paper has to be smooth and impermeable. These properties are vital when it comes to ensuring smooth running at the print head and low abrasion, in other words avoiding print head wear.

In the case of topcoat papers the thermal function coating is shielded from environmental influences of a mechanical and chemical nature by an additional protective coating. Generally speaking, thermal paper with a topcoat is smoother than paper without a topcoat.

The higher density and special surface characteristics of thermal paper affect printability and ink requirements. The inks must have the following properties:

- > Heat resistant to 230°C
- > No abrasive components (e.g. metal pigments in spot colours and TiO₂ in opaque white) that might cause damage to the thermal print head
- > Good adhesion to thermal paper with a topcoat
- > Good wetting behaviour
- > No chemical components that will attack the thermal print head
- > Good reactivity for reliable drying

“The most successful processes used for small-format reel printing of thermal paper (continuous form printing) are flexographic and offset printing. Both these printing processes will be examined in greater detail in this brochure. Letterpress and letterset printing are also touched on in passing. The general rule for all the methods used for pre-printing and processing thermal paper is as follows: the correct functioning of the thermal paper (in a thermal printer) must not be impaired by the chosen printing process.”

*Matthias Marx
Application Engineer
Dr Bernd Gerecht
General Manager,
Marketing & Strategy
Mitsubishi HiTec Paper Flensburg*



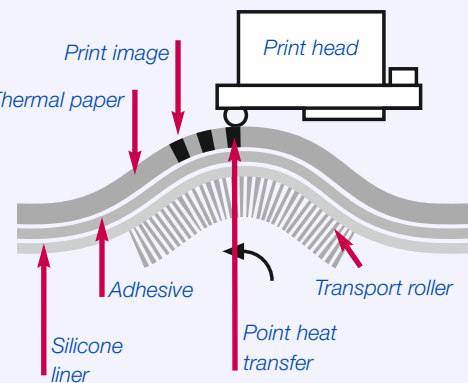
Strong under pressure

Printers who put their faith in thermal paper will achieve first-rate results, but experience is vital and the following technical requirements have to be met:

- > Special inks suitable for thermal paper, preferably UV inks, have to be used
- > Inks containing polystyrene, which sticks to the thermal print head, must never be used
- > A precise colour/water balance and as little fountain solution as possible
- > Care must be taken that the inks cure sufficiently
- > Several UV dryers should ideally be used
- > In the case of thick layers of ink, several UV dryers should be used immediately after each ink station
- > To prevent ink from building up on the rubber blanket, drying has to be optimised and the right rubber blankets (quick-release products) have to be used.

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– the brand for an excellent thermal print image

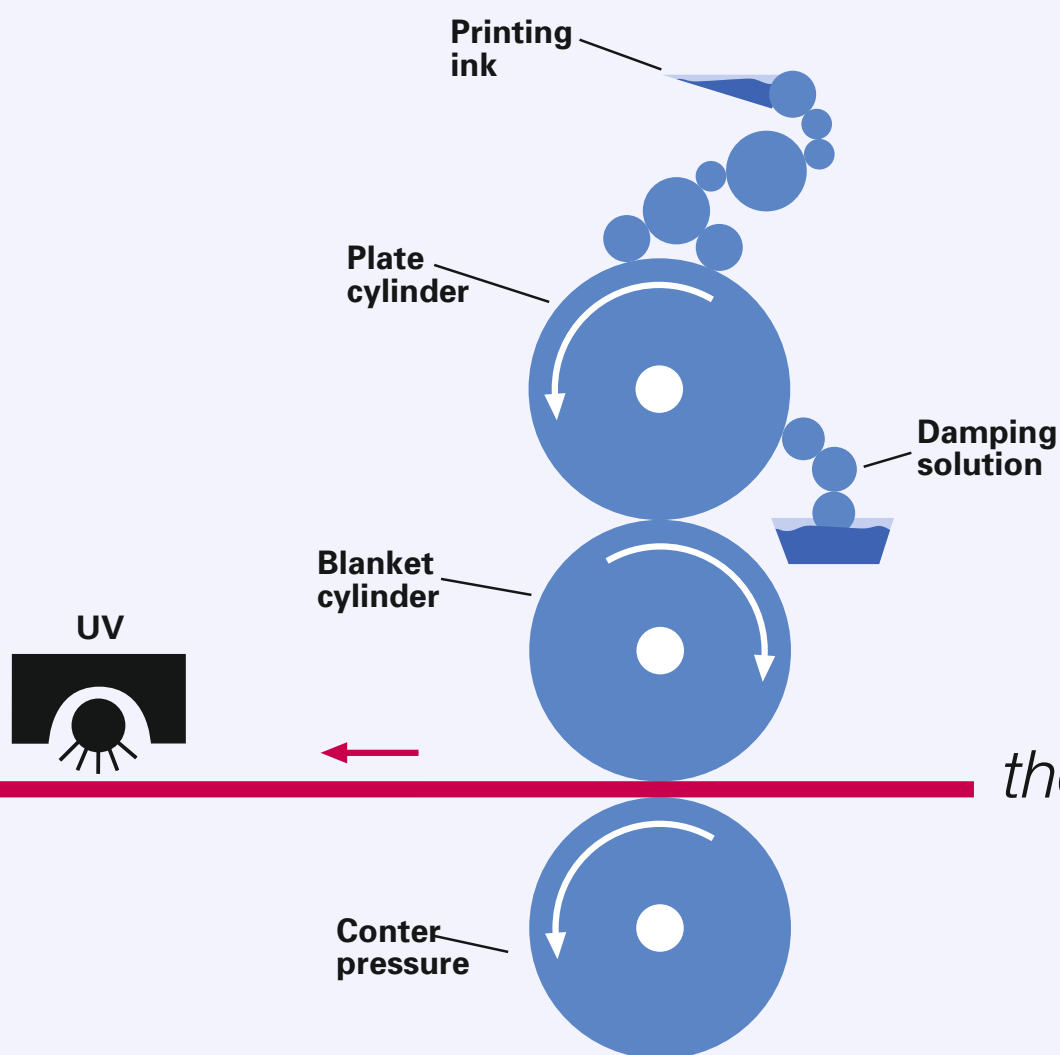


Thermal paper and offset printing

Offset printing is now the most widely used standard printing process.

The technique is based on the mutual repulsion of water and oil (ink). The ink is transferred indirectly. First it is transferred from the printing plate to a rubber blanket and then to the paper using low compressive stress. Rotary printing means that high printing speeds of up to 300 m/min. are usual for multicolour printing on thermal paper using UV drying systems.

The wet offset technique with UV curing is being used more and more for thermal paper in particular thanks to the excellent results it achieves (very good point sharpness/high resolution).



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Offset printing with UV inks

Conventional oxidative/penetrating ink systems are not absorbed quickly enough by the surface of the thermal paper. This is because penetration is too slow. This causes poor drying of the ink and all sorts of associated problems, including sticking, setting-off and fouling of guide rollers.

The drying mechanism of UV-curable ink systems is the most successful and reliable option for thermal paper in wet offset, letterset and letterpress printing. The surface properties of thermal paper vary in their absorbency/wetability, affecting wet offset printability.

- > **Non-topcoat thermal paper** does not have a topcoat or protective coating over the heat-sensitive function coating. Such paper is therefore more vulnerable to chemical and mechanical influences. It has a more absorbent, wettable surface. Because it has no topcoat, its surface strength (wet picking resistance) is lower.

UV offset



“UV lamps after every printing unit and picking-resistant, quick-release rubber blankets suitable for use with UV are other important factors in achieving good print quality on non-topcoat products.”

*Roland Glatthaar
Printing Expert
Mitsubishi HiTec Paper*

The printing ink manufacturers can use suitable additives to reduce the tack (adhesion) of the ink. This stops ink/paper components building up on the rubber blanket.

UV-reactive thinners (thinning agents with photoinitiators) are the most reliable way of tailoring the printing ink to the thermal paper without changing the concentration of the photoinitiators in the ink, which are responsible for starting polymerisation and controlling curing rate.

As reduced ink tack leads to increased dot gain and poorer contrast, only as much thinner as absolutely necessary should be added.

- > **Topcoat thermal paper** has very low absorbency because of the topcoat. The impermeable surface means that only a tiny amount of fountain solution can be absorbed by the paper from the non-printing areas on the printing plate (indirectly via the rubber blanket). The characteristics of the paper are more like those of foil, so ink suitable for foil should be used. The amount of fountain solution available should generally be kept as small as possible in order to prevent the printing ink from absorbing too much.

UV-curable inks and thermal paper

The undisputed advantages of UV-curable ink systems on thermal papers come into their own if complete polymerisation of the ink is ensured by providing enough lamp power and keeping the UV system in good condition. The initiator content of the UV ink also plays an important role in this respect and needs to be tailored to the printing conditions. (If in doubt, ask the printing ink manufacturer.)

Exposure to UV radiation is supposed to achieve complete cross-linking of the ink film with a view to guaranteeing the required durability by means of stability. Inks that are not cured sufficiently or not heat-resistant enough will behave thermoplastically under the thermal print head – in other words they will soften. This can lead to fouling or, in the worst case, even to complete jamming of the print head.

UV ink components that are not cross-linked can migrate into the thermal coating and cause an unwanted reaction.



Requirements for UV printing inks

UV inks are solvent-free printing inks based on a liquid, photoreactive binding agent. Photoinitiators trigger curing when exposed to UV radiation. In addition to the general requirements for UV inks used with thermal paper, UV inks for wet offset printing must also have:

- > a good fountain solution balance
- > low tack to prevent paper/ink components from building up on the rubber blanket

The following factors are also important:

- > Only use printing ink ranges that have been recommended by the printing ink manufacturer as suitable for thermal paper
- > Order the "Technical Datasheets" for these ranges from the printing ink manufacturer and follow them to the letter
- > Only use an printing ink additive if the datasheets describe how to use it and specify how much to use.

UV curing

The UV drying system must have sufficient lamp power and be in a clean, functional state that ensures optimum ink curing.

Complete curing of the UV inks is vital if fouling of the print head is to be avoided. Regular checks should be made using a suitable test method (acetone test or similar).

Offset balance

The amount of fountain solution available should generally be kept as small as possible in order to prevent the ink from absorbing too much. There are two main reasons for this:

- > Topcoat papers in particular absorb hardly any fountain solution (low absorbency). This means that the fountain solution stays in the printing unit
- > UV inks cannot generally absorb much fountain solution

Rubber blankets

Quick-release rubber blankets used in conjunction with inks that have had their tack reduced using suitable additives minimise the tendency for residues to build up when non-topcoat thermal paper is used. Their use is therefore recommended.



Flexographic press for water-based ink systems

The general requirements for inks for use with thermal paper must basically be complied with when using UV-curable and water-based flexographic inks.

Thermal paper and flexographic printing

Flexographic printing

Flexography is a special letterpress process that has been around for about a hundred years. All flexographic presses are rotary. The ink is transferred directly to the substrate using flexible printing plates.

It was not until water-based, UV-curable inks were developed that flexographic printing made the breakthrough for use with thermal paper. Now both topcoat and non-topcoat thermal papers are frequently printed using flexography.

Special features

Conventional flexographic ink systems containing solvents would migrate into the thermal function coating and cause an unwanted chemical reaction.

Water-based, low-viscosity flexographic inks and the UV curing method have stood the test of time when it comes to printing on thermal paper.

Requirements for UV-curable flexographic inks

UV inks are what are known as 100%-solid systems. This means that they contain no solvents whatsoever. Unlike with inks that contain solvents, no solvent must be added to them under any circumstances. If the ink needs to be adapted to suit certain requirements – e.g. brightening, faster curing, etc. – only the additives specified by the manufacturer must be used.

The viscosity of UV flexographic inks remains constant within narrow limits, as nothing evaporates in this system. Their viscosity only varies with temperature and under shear.

Requirements for water-based flexographic inks

In contrast to the chemical drying of UV inks, water-based flexographic inks dry by physical means (evaporation, absorption of solvents). It is important to be aware of variations in composition, as the term “water ink” is defined in different ways:

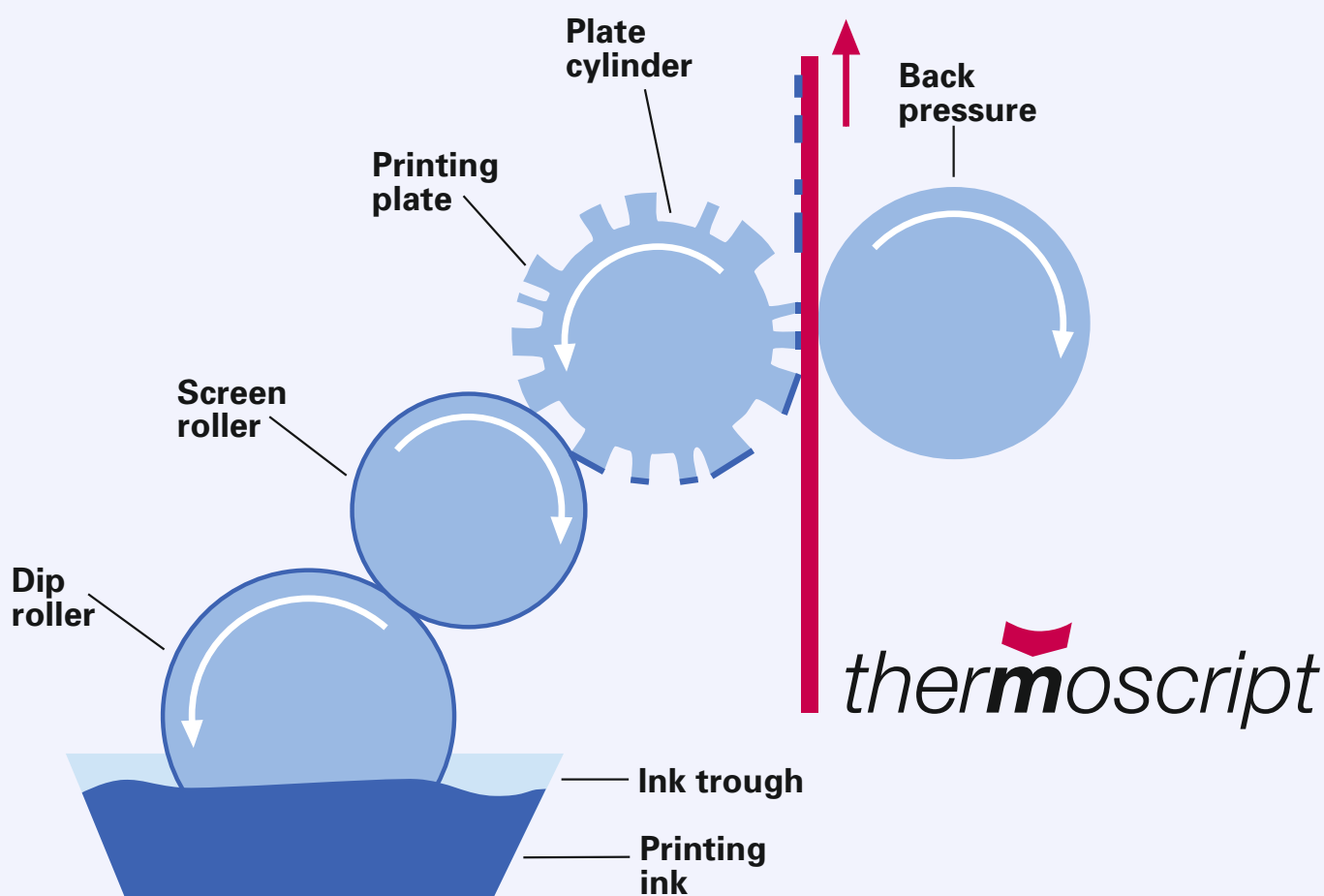
- > **Water-dilutable flexographic inks**
contain a relatively high proportion of solvents with an alcohol content of 10-15 per cent. These inks can be diluted with water. They are not true water inks, however.
- > **Water-based flexographic inks**
have a solvent content of less than 5 per cent, making them true water inks.

Topcoat papers are protected by the topcoat and so can be printed on without difficulty.

Non-topcoat papers are far more sensitive because of not having a topcoat. If a water ink contains too much solvent (carry out a test before using), it will trigger a reaction in the thermal coating. In some cases discolouration will not occur for an hour. The slower the alcohol evaporates, the longer the reaction takes.

Water-based flexographic inks with their low alcohol content of less than 5 per cent do not have a negative effect on non-topcoat papers.

In the case of ECO papers flexographic inks must not contain too much ammonia or discolouration will occur



Flexographic printing

The following should also be noted:

- > A change in the paper caused by an unwanted thermal reaction is most easily detected with light colours such as yellow or mixing white. It is also important to check the additives used, as they can have a significant effect on discolouring, depending on their alcohol content.
- > The dryer temperature will depend on the sensitivity of the thermal paper used and the printing speed.
- > The different wetting properties of topcoat and non-topcoat papers must be taken into account when the anilox roll is chosen.
- > Only use printing ink ranges that have been recommended by the printing ink manufacturer as suitable for thermal paper
- > Order the "Technical Datasheets" for these ranges from the printing ink manufacturer and follow them to the letter
- > Only use an printing ink additive if the datasheets describe how to use it and specify how much to use

Between professionals

All *thermoscript* grades can basically be used with the printing techniques in general use today. Having said that, the interaction of all the elements involved in the process (press, thermal paper, inks, additives) has to be optimised if the best results are to be achieved.

Mitsubishi HiTec Paper has a great deal of experience in the theory and practice of printing on *thermoscript* grades. Our printing experts will be happy to answer your questions.

If you have any special technical questions to do with printing, please get in contact with

Matthias.Marx@mitsubishi-paper.com

Roland.Glatthaar@mitsubishi-paper.com

Talk to us

Our customers challenge us. They don't want standard products, but individual solutions.

At Mitsubishi HiTec Paper the staff in R&D, marketing and sales work together with the engineers and paper technologists to develop the right grade for every application.

Mitsubishi HiTec Paper stands for global service and top quality. Long-standing business relationships with customers all over the world show that Mitsubishi HiTec Paper is on the right track.

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Some ink manufacturers for *thermoscript* grades

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www.intercolor-ink.com
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www.rodatzflexo.de
www.tk-toka.co-jp
www.osakaink.co-jp
www.toyoink.com

This overview with regard to printing ink manufacturer is primarily informative. Since we can distinguish between many different *thermoscript* qualities, differing from standard paper, testing and optimisation is mandatory to achieve optimum results.

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 we have a global presence.
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