

The Pad Printing Process



The pad printing overview:
pad printing, printing pads, plates,
pad printing inks, adhesion und antistatic



Teca-Print was founded in 1973 in Thayngen, Switzerland, and belongs to the world's leading pad printing machine manufacturers. The high-quality Swiss products are developed and produced in-house by Teca-Print. By the further dynamic development of the products and the constant adding of technical innovations we have succeeded to integrate pad printing into new market segments.

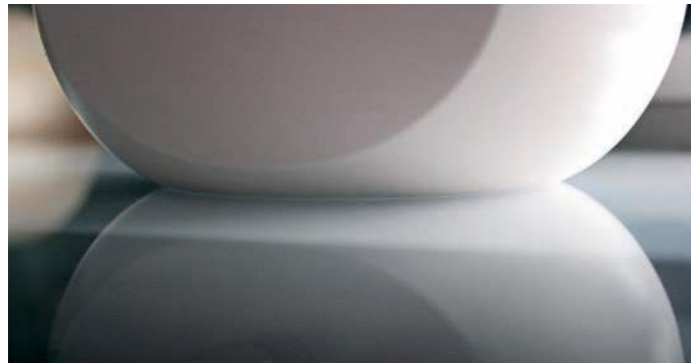
The Teca-Print product range includes pad printing machines and systems, peripheral devices, accessories as well as consumables as pads, plates and inks. For every product Teca-Print offers training, service and maintenance.

In addition to our head office in Thayngen, Teca-Print also has subsidiaries in Germany, France, Hungary and the USA. Our 29 mostly long-standing distribution partners provide deliveries and customer service worldwide.

Since 2002 Teca-Print AG has been an independent part of the French Groupe Dubuit SA enterprises, that specialises in different fields of printing. Within the group we offer not only pad printing but also screen printing, digital printing and hot stamping.

Our multilingual website www.teca-print.com contains information that is constantly updated. Here you can find news regarding recent developments and current offers. Additionally, all our product data sheets are available to download.

We are pleased to welcome you at Teca-Print in Thayngen. In our showroom we will show you our different pad printing machines and how they work. You can also visit us at an exhibition. Further information can be found on our website.



The pad printing process has undergone a rapid development in the past 40 years and is now one of the most important printing processes.

The use of silicone rubber was instrumental in bringing about its success as a print medium (pad) because it allows easy deforming, it is ink repellent and as a result ensures an excellent ink transfer.

Pad printing enables printing on uneven surfaces. The printed images vary from simple markings to multicoloured photo prints.

The pad printing process is flexible and versatile. To meet the demands of the market pad printing continually rises to new challenges.

What started out as a method to print simple marks and inscriptions now goes beyond to the artistic decoration

prints. The range of pad printing starts with functional markings such as on measuring cups or on switch buttons, and has been supplemented in the past years by an important factor: the product should look «pretty» because today look and design are significant factors that contribute to the sales success.

Origins of pad printing

The inventor of the pad printing process will most likely remain a mystery. The roots of the pad printing process lie in the watch- and ceramic industry.

The direct predecessor to pad printing is the Decalier Process, which was used in the Swiss watch industry. In that process a gelatine pad was used to transfer the ink onto watch faces.



Tampondruckmaschine
TPE 151

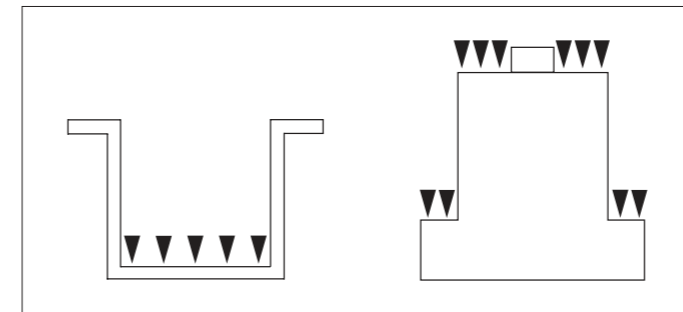
What is pad printing?

Pad printing is an indirect photogravure process. Depressions are etched into a flat plate. These depressions are filled with ink and a smooth silicone pad (silicone is ink repellent) is used to pick up some ink on the plate and transfers it to the object. This stamp is called pad and gave this printing process its name.

The advantages of pad printing

Thanks to the flexible substance of the silicone the pad can adapt to the object during the ink transfer. This enables printing not only on flat, but also on uneven surfaces. Even surfaces with structures or embossing can be printed with pad printing.

The use of height compensators allows printing at different heights in only one printing process.



Pad printing makes it possible to print at different heights or in cavities.



Distinction between pad printing and other methods of printing

Every printing method such as pad printing, digital printing, screen printing and hot stamping has its pros and cons that define if it is suitable or not for a specific application. The printing methods might compete in certain areas, but usually the advantages complement each other and offer the user the ideal solution for every application.

The special brilliance of gold- and silverfoils can not be achieved in any other way than with hot stamping, but in return screen printing offers ink coverage across large areas. Pad printing has its strength in printing uneven surfaces among other things.

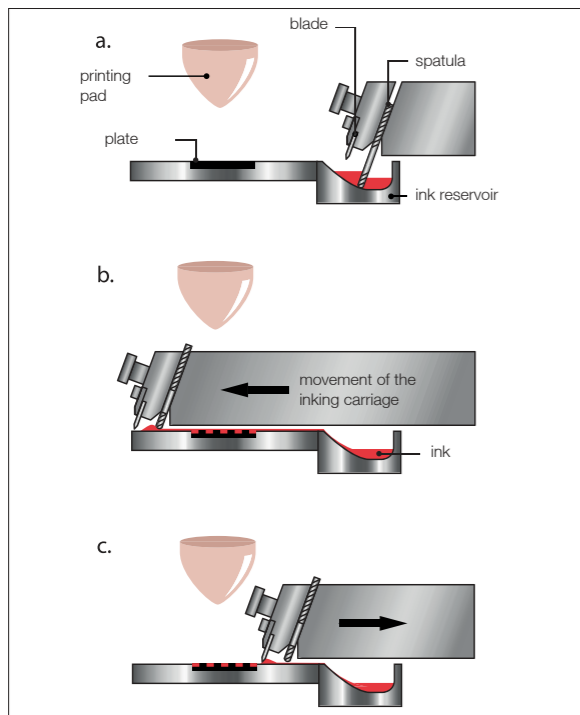
The ink transfer

When a printing cycle with an open ink well system is triggered, the ink that is lying on the plate is drawn back into the ink reservoir by a blade.

In a sealed ink cup system the ink cup glides from its position over the printing image. The ring blade takes off the excess ink in the process.

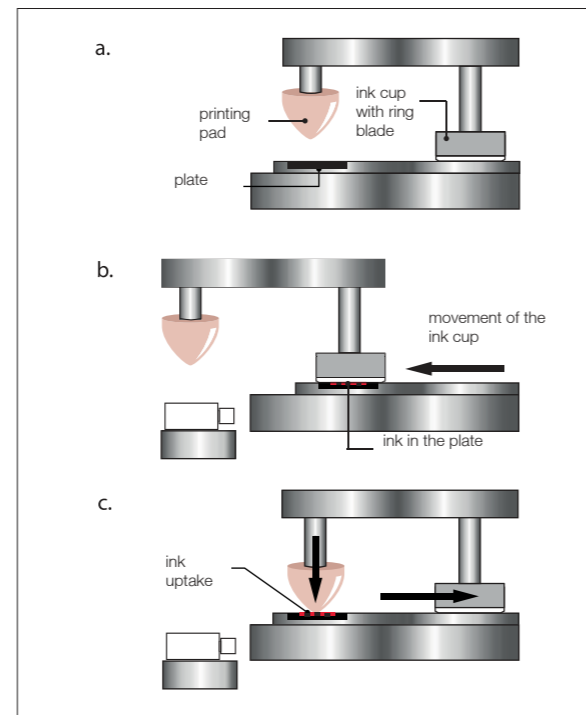
The ink only remains in the depressions of the plate. The thinner in the ink evaporates, causing the ink to become sticky. The pad is then lowered onto the plate's surface and the ink is transferred from the plate to the pad. The ink on the pad is then transferred to the to be printed surface. When being applied the ink detaches from the pad and stays on the object.

Open ink well system



- a) Initial position of the inking carriage before the plate is flooded with ink.
- b) Flooded plate, basic machine setting before starting the printing cycle.
- c) The blade draws the excess ink back into the reservoir.

Sealed ink cup system



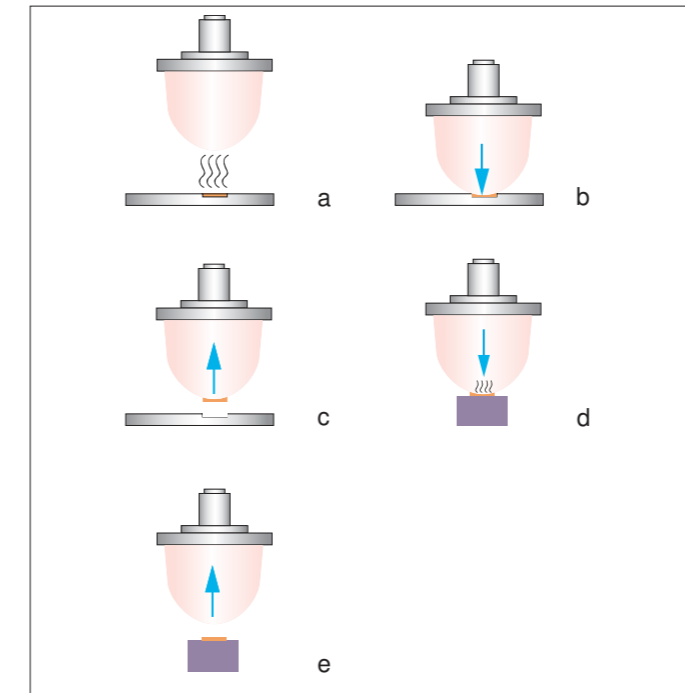
- a) Initial position of the ink cup before the plate is flooded with ink.
- b) Flooded plate, basic machine setting before starting the printing cycle.
- c) The ring blade of the ink cup draws the excess ink back.

Ink pick-up and ink transfer

The following illustration shows the ink transfer process. Printing pads are used as a transfer medium. They pick up the ink from the plate and apply it to the object.

Ink layer thickness

The thickness of the ink layer that is transferred in pad printing is approximately 4 to 10 microns. The ink's thickness depends on the type of ink, the ink tone, the ink viscosity, the pad material, the etch depth of the plate and the atmospheric conditions such as heat, humidity etc.



- a) The thinner evaporates from the surface of the ink in the plate and the ink becomes sticky.
- b) The pad sinks down on the surface of the plate and the ink sticks to the pad.
- c) The pad is then lifted from the plate. The ink layer is detached from the plate.
- d) The ink is carried by the pad to the surface of the component. The thinner evaporates from the ink on the pad. The ink becomes sticky and is applied to the component's surface.
- e) The pad is lifted off the component and the ink layer detaches from the pad and stays on the component.

Multi-colour printing

Thanks to the thin ink layer that is transferred in pad printing, it is possible to carry out a multi-colour print «wet», without drying inbetween. For this we offer different peripheral devices for example:

- Pad sliding devices for two colour printing
- Rotary tables
- Shuttle tables
- Transfert Carrés
- Incremental launch



Pad printing machine TPX 301 for multicolour printing with swivelling pad height compensators and shuttle table

Printing pads

The printing pad plays a significant role in pad printing: It is one of the deciding factors for producing excellent print results. Teca-Print manufactures high-quality printing pads tailored to the needs of pad printers and backed by a qualified team for support. With a commitment to excellence, silicon grade and pad shapes are continuously evaluated and improved.

Printing pads are made of silicone and are available in different qualities, forms and hardnesses.

Pad families, silicon types and hardnesses (i.e. durometer)

The pad's ink transfer performance varies depending on the properties of the silicon.

There is a wide range of silicon types to choose from in order to find the ideal pad for each application and to optimize the print quality.

The hardness of the pads are measured in Shore. Teca-Print uses the scale according to the system 00 Si. The production tolerance is ± 2 Shore 00 Si.

Generally speaking, pad durometers range from 39 Shore 00 Si (very soft) to 70 Shore 00 Si (very hard). In addition to the quality of the surface and shape of the part to be printed, the printing force of the machine and the size of the printing image must also be taken into consideration when choosing the proper pad durometer.

Quality «Standard»

The standard family of printing pads is very universal in their application. Good anti-static as well as anti-welling properties make the printing of diverse, high quality images with this pad possible, even the transfer of fine-lined images.



standard red:
54 Shore 00 Si

standard green:
44 Shore 00 Si

standard white:
39 Shore 00 Si

Quality «blue»

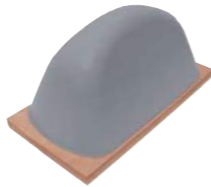
The blue family of printing pads is hard and well-suited for very precise print images. They are also used for special applications, e.g. relief prints and are widely popular in the watch industry.



blue:
64 Shore 00 Si

Quality «StarX»

The StarX family of printing pads distinguishes itself with particularly good antistatic properties, excellent resistance to mechanical abrasion, as well as perfect ink transfer (i.e. rarely leaves ink residue and practically no ink splashing). A unique feature of the StarX printing pads is that it requires no laborious activation, and thus, they are quick to be put into production.



StarX:
64 Shore 00 Si
54 Shore 00 Si
44 Shore 00 Si
39 Shore 00 Si

Quality «AreX»

«AreX» printing pads are described as «super dry» printing pads. Only encapsulated oil is used, so that no oily residue remains on the surface after printing. This is a quality, that is often required by the electronics industry. The AreX printing pads possess several convincing features including excellent fine-image transfer, very good resistance to mechanical abrasion, optimised anti-swelling and good antistatic properties.



AreX:
70 Shore 00 Si
64 Shore 00 Si
54 Shore 00 Si

Quality «Long-Life»

The Long-Life family of printing pads demonstrates a particularly high level of resistance to mechanical abrasion. Good antistatic and anti-swelling properties round off the benefits of these pads.



Long-Life:
54 Shore 00 Si
44 Shore 00 Si

Quality «FDA»

The FDA family of printing pads satisfies the strict guidelines of the U.S. Food and Drug Administration (F.D.A.) and is used predominately in the medical industry due to its special features. FDA printing pads are shipped in air-tight packaging and with an aluminum pad base. This pad is resistant to tearing and possesses very good mechanical abrasion properties.



FDA:
64 Shore 00 Si
54 Shore 00 Si

Pad shapes

Nearly 2000 different pad shapes are available at Teca-Print. Additionally, special shapes, pad clusters and combinations, as well as pads developed for custom applications are part of our pad service.

In principle, the ideal shape of pad can best be determined by considering the print image together with the shape of the part to be printed. The main shape groups include round, square and rectangular, however, all of these main groups can be found throughout the various sub-groups.

The selected shape determines the manner in which the pad rolls during compression and directly influences the quality of the resulting print. The OrbiX printing pads with their innovative surface geometry are only available at Teca-Print. The pressure increase during ink pick-up and transfer occurs evenly across the pad surface. The ink transfer and print accuracy are enhanced and the resulting print is optimized.

The OrbiX printing pads are available in all of our pad families, so that you don't have to sacrifice your favorite silicon for the ideal shape.

The Golden Rule of pad selection

The rule below should be followed when choosing a printing pad:

Always choose the hardest, most pointed and largest pad possible.

The hardness of the pad helps to print sharp contours and ensures perfect prints on structured surfaces. The steeper the pad is, the better the air can escape (i.e. during ink pick-up and transfer).

The largest pad volume possible minimizes image distortion, as larger pads deform less.

Plates

Activation

New printing pads must be de-oiled before using them for the first time, so that the pad is activated for printing. Great care is required during the activation. Use soft paper towels, soaked with ink thinner (e.g. VD, VM) to wash down the pad surface. Important: dry rubbing or scrubbing can create an eraser effect and damage the pad surface. Once the surface is matt and the thinner evaporated, the pad can be used to print.

Cleaning

The dust and ink residue left on the pad surface should be cleaned with adhesive tape only.

Storage

Store pads in an area without sunlight and keep them away from direct contact with other parts (incl. other pads).

Pad base and fastening

Both wood and aluminum are used as pad bases. All Teca-Print printing pads with a wooden base have a M6 thread in the middle (if size and form allow). Printing pads with this pad base can easily be mounted to the corresponding pad holder containing a M6 threaded pin.

The plate plays an important role in pad printing as it holds the printing image that is transferred by the pad to the object. The quality of the plate and the printing image affect the quality of the print directly.

Plate types that are suitable for pad printing:

- Plastic plates
- Steel plates
- Steel plates 05
- Ceramic plates

Within the different plate types there are many further divisions, so that there is a suitable plate for each application and machine fitting.

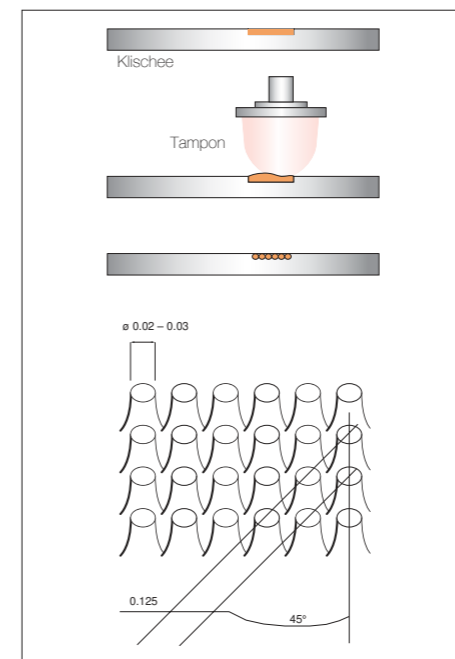
Apart from ceramic plates that are lasered, printing images are etched into the photo sensitive layer on the surface of all the other plate types. A film with the image is placed on the plate and exposed under UV-light. The parts that were covered by the image stay soft. Depending on the plate type the soft parts are washed out or etched.



Large images must be created with dot points so that the blade respectively the ink cup does not spread the ink unevenly on the plate. During the ink transfer the printing pad penetrates the ink layer through its unrolling motion, and an uneven ink deposit results in an uneven print image. In order to avoid this, dot points are screened into the larger parts of the print. These dots support the blade and prevent it from scooping or removing too much ink. Plastic plates are always screened. For this screen films with 120 lines per cm or 80 lines per cm are available.

Plastic plates

Plastic plates can be used for many different applications. They are cost-effective and offer high flexibility thanks to the fast and easy exposure process. They are suitable for small and medium size production series. Plastic plates consist of a thin metal sheet that is coated with a light-sensitive plastic layer. After light exposure the plate is washed out with washout solvent or with water. The selection between standard or Long-Life-plastic plates depends on the application.



With large images screened plates help to prevent the blade from scooping down and removing too much ink.

Steel plates

Steel plates consist of high quality special steel (hardness approx. 65 Rc) and due to their high abrasion resistance they are suitable for large series. Steel plates usually have a thickness of 10 mm. With smaller plate sizes also thicknesses of 6 or 8 mm are used. As special models steel plates with polished surfaces and steel plates with chrome steel parts are available. Teca-Print steel plates are prepared with a photo sensitive layer for etching. For used steel plates Teca-Print offers, in regard to the high material cost for steel, a grinding and lapping service: the steel plates are smoothed, lapped and newly coated, so that they are ready for the next etching procedure.



Plate (Clichés)

Steel plates 05

Steel plates 05 are plates made of thin steel (approx. 0,5 mm). They are suitable for middle size productions. They have the same photo sensitive layer as the thick steel plates and undergo the same etching process. Teca-Print offers two types of steel plates 05. Ecoprint-steel plates with grinded surfaces and Recoprint-steel plates grinded and lapped surfaces.



Ceramic plates

Ceramic plates are plate consist entirely of ceramic and offer an interesting alternative for some applications. They are often used when a particularly long lifetime is required and only the slightest abrasion can be tolerated. Ceramic plates are always lasered. The significantly deeper etch depth, that is possible with laser etching, offers the transfer not only of ink but also other mediums such as glue or medias with high pigmentation.



Film- and Cliché service

Teca-Print offers a professional reprographic and cliché service for all plate types. Our experienced employees in the reprographic department have high quality equipment to produce an optimized film for pad printing. The complete data can be delivered in the data format *.ai, *.eps or *.pdf.

Line graphics should be vectorized and fonts should be converted into paths, alternatively please deliver all font styles.

In principle the quality of the data is checked regarding the fineness, black content, contour sharpness, etc. as the film quality must be perfect for an optimal printing result.

If a complete graphic is not available we are happy to take over the creation of the data for the printing image. After the film production Teca-Print offers to carry out the light exposure respectively the etching of the plate for you.

For the production of the plastic plates, the steel plates and the steel plates 05 state-of-the-art equipment is used. The combination of high-performance technology and our long-standing experienced employees guarantee a professional realisation of your cliché.



Inks

Inks

The selection of ink depends on the demands, which are placed on the ink. Some examples are the abrasion, solvent, weather resistance or resistance to other substances such as grease, oil, cosmetic creams, sweat, acids, chemicals, thinner, gasoline, etc.

Ink composition

All of the inks used in pad printing have been specially developed and adjusted for quick processing and production. Epoxy, polyester or other resins are used as binding agents into which the pigments are worked with a rolling mill. Other components are solvents, leveling agents, fillers and additives.

One component inks

In many applications single-component inks can be used, which are easier to process due to their long cup life. They are also cost-effective and mostly have a very high abrasion resistance. The curing takes place physically or oxidative.

Two component inks

These inks are used for applications that require a high level of mechanical demands and resistance, e.g. key pads, switches etc.. After the physical drying, i.e. after the evaporation of the thinner, the chemical reaction starts. The curing is mostly completed after six days.

Mixed inks

Ink mixing systems were developed by the ink manu

facturers and provide a cost-effective solution for reproducing all Pantone and RAL colour tones according to their recipe. Teca-Print offers ink mixing services also for small amounts starting from 0,5 liters respectively kg.

LED-inks

LED-inks are an innovative development of the previously used UV-inks. They have the advantages of the UV-inks but are easier to dry and are environment-friendly.

The ink is easy to process and has a long cup life. Thanks to the LED curing the ink is dry immediately after passing through the dryer. In comparison with the earlier known UV dryer the LED curing is considerably less expensive and needs less energy. No ozone is produced.

Ink adjustment

Inks are delivered ready to use; however, the ink must be adjusted to the proper viscosity with thinner prior to use.



Viscospatula

Teca-Print has developed the Viscospatula to make the measuring of the ink's viscosity possible while the ink and thinner are being mixed. During the mixing process the following steps must be observed:

- With two-component inks, the ink and the hardener must always be thoroughly mixed together first.
- Thinners and retarders, which are used to adjust the ink viscosity, must be added to the ink in very small amounts while stirring continuously.
- If this is not done correctly, pigment shock occurs. This means that the pigment is separated from the resin base and can no longer be mixed together again. This is known as «coagulated ink.»
- Some inks have thixotropic tendency due to their ink pigment type and cannot be tested using the above mentioned process.



Adhesion

In pad printing a wide range of ink types are available, that are suitable for the use on different base materials. Thanks to constant development there is hardly a material without a matching ink. Depending on the surface tension of the to be printed part pre- or posttreatment could be necessary to obtain the desired adhesion.

By using solvent the surface of the to be printed part becomes sticky and helps to bind the ink with the surface material. The adhesion is very good.

If the surface does not become sticky when using solvent, it usually has to be pre-treated to ensure a good adhesion. Some materials also need to be post-treated.

Pre-treatment

Components made of polyolefine, polyethylene and polypropylene must undergo pre-treatment to ensure the proper adhesion as their surface tension is too low. The surface tension of a component can be tested with a pen and if it is below 38 dyne/cm, the component must be pre-treated using one of the following processes.

Flame treatment

The printing surface that requires treatment is passed under an open flame. This causes scarification of the base material. The result is an increased surface tension. The flame intensity is controlled by the operator and the length of time necessary for the flaming is substrate-specific. Flaming does, however, remove the gloss of the components surface area. This must be taken into account if a glossy is desired.

Antistatic

Corona treatment

The pre-treatment process can also be accomplished by using electric Corona equipment. In the Corona pre-treatment process the printing surface is bombarded with ions and electrons that cause the static charge of the uppermost layer of molecules to change. This also results in increased surface tension.

Corona pre-treatment is based on a high-voltage spark with a voltage ranging from 5 and 15 kV at frequencies between 15 and 30 kHz. This process is preferred over the flame pre-treatment process as it is less hazardous, because there is no open flame involved.

Bonding agent

A third pre-treatment process is the use of a bonding agent. This is a chemical process which requires the components surface to be coated with an agent. The surface is chemically etched and is ready for processing. The use of the bonding agent as a pre-treatment process is only economical in small series. This process requires the access to a well-ventilated room.

Post-treatment

The main purpose for treating components after the printing process is to reduce the curing time. Post-treatment, or curing, is usually used in applications where the components will undergo additional processing within a relatively short time. The methods used to cure a printed image include flame treatment, hot air treatment or the use of an infrared dryer. It is important to note that with two-component inks, even after undergoing a post-treatment process, the full curing (that is, molecular bonding) does not take place for six days.

Mechanical abrasion causes electrostatic charge, that lead to undesired effects. These become visible in the form of splashes that appear around the contours of the printed image. The better the antistatic performance of the to be printed material, the less abrasion and the better the derivation of excess electrostatic charge.

Ionization

Many plastic components build up an electrostatic charge. Static electricity has an adverse effect on the printing process because the image «picks up» the charge during the transfer and the print becomes distorted. Using de-ionizing equipment on the components not only eliminates the static electricity build-up, but also removes dust particles that have accumulated on the components surface.

Antistatic agent

Another way to avoid electrostatic charge ist to mix antistatic agent into the ink.

The surrounding condition also influences the antistatic charge next to ionization and antistatic agent.

A high humidity for instance also helps to avoid electrostatic charge.

Pad printing process - overview

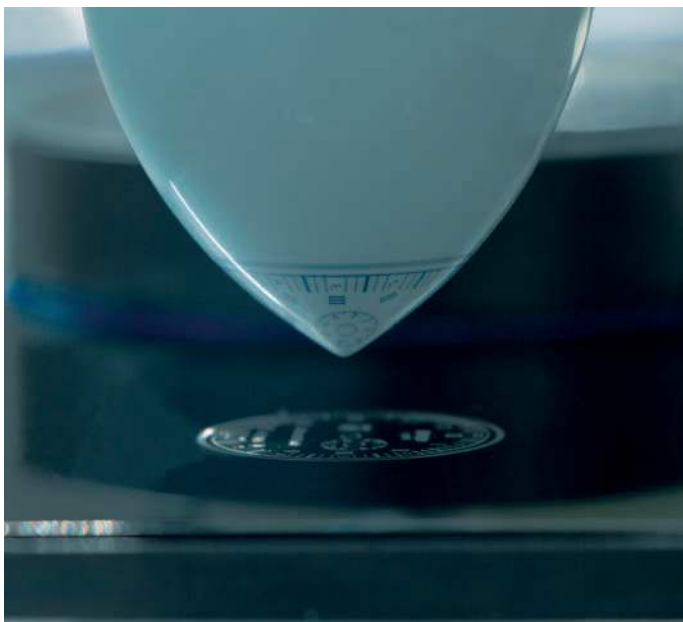
Summary

Pad printing is very versatile. Many objects can be printed with little effort.

Thanks to consequent further and new developments in the field of consumables as inks, pads and plates continuously new application possibilities are found.

At the same time technical innovations provide better solutions. Camera systems are increasingly used. Depending on the requirements and applications the position of the object in the jig and/or the printed image itself is checked. If required an automatic correction of the print can be configured, if for instance the printing position is not exact.

Especially with high quality objects the use of cameras is useful to avoid the cost of misprints.



Overall pad printing can be used for many different applications in various industry sectors.

Here are a few examples:

- ◆ watch industry
- ◆ mint industry
- ◆ electro- / electronic industry
- ◆ semiconductor industry
- ◆ computer industry
- ◆ telecommunications industry
- ◆ consumer electronics
- ◆ medical branch
- ◆ optical / jewelry industries
- ◆ automobile industry
- ◆ household appliances
- ◆ sport articles
- ◆ toy industry
- ◆ brush industry
- ◆ bottle cap industry
- ◆ general plastics industries
- ◆ promotional gift industry...etc

For further information about us and our products please visit our website www.teca-print.com.



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