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PRINTING ONTO CERAMICS AND GLASS

My main function is to optimise metacognative mastery–learning by being able to synergize learning-intensive differentiated lessons. The key is to exploit holistic instruction by streamlining group based facilitators who in turn repurpose learner-cantered convergence enabling them to disaggregate the problem-based outcomes and reinvent open-ended learning.

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This is an example of what we are faced with when talking to some consultants, bureaucrats, trainers and educationalists. In simple terms they are talking out of their anus. For those who listen to Radio 4 there is an excellent program where you have to work out who is telling the truth. One of the explanations was that giraffes communicate by drawing and expelling air from their rear ends. So when faced with an individual using such terminology consider them as a farting giraffe. This use of jargon is increasingly common in business and simply complicates matters. That does not mean that the use of technical terms should be discouraged as often they are the best way of explaining a process or method. If the words are nearly all more than four syllables you have to wonder if the user knows what they are talking about. This month I am writing about printing onto ceramics and glass. The terms: frit, lehr, radiation cure, flux, reducing, fire, medium are all used in this area of printing.

The starting point for printing onto ceramics and glass is the range of inks that can be used to print onto these materials. The inks fall into categories:

1) Inks or enamels that contain finely powdered glass or frit, inorganic pigments and are fired in a kiln known as a lehr up to a temperature in excess of 600^{o}C
2) Inks containing organic pigments and resins that are heated up to 200^{o}C.
3) Inks containing organic pigments and resins that are cured by Ultra Violet radiation.

INORGANIC PIGMENTS

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When printed onto ceramics and glass that are subjected to automatic dishwashing the ability to withstand this process is crucial. There are ISO standards for this but probably a good guide to resistance is the one provided by **FERRO** ® one of the premier worldwide producers of the components and finished enamels for this market. They consider an ink should withstand more than 500 washing cycles largely undamaged in professional dishwashers for catering use without significant deterioration of the printed film.

This is a very fierce environment. Water mixed with detergent and other chemicals is a very aggressive solution, far worse than many solvents. As the temperature of water increases so its surface tension decreases. If you add detergent to water the surface tension reduces still further and effectively makes the water wetter. The solution is alkali; hence this provides a very severe test for these inks. There are other tests applied to inks used in this application, the effect of acids present in beverages and during washing, even the presence of sulphur in some corrugated packaging has to be taken into account.

Not all inks have to withstand dish washing (thank goodness,) in other applications there is a need to withstand other environments. Surprisingly printing onto glass cosmetics containers can provide similar challenges. Cosmetics containers need to be able to cope with very aggressive perfumes and other natural oils. One particular aftershave that was normally held in a glass bottle needed to be put into a plastic container. Conventional plastics could not hold it as the container melted when in contact with the aftershave. It was necessary to use a special moulded laminate to withstand the chemical attack. If people realised how aggressive these materials are they would not be so keen to put them on their skin.

To obtain the highest level of product resistance when printing onto glass the best solution is to use inks that are fired on, however this process is expensive and time consuming. The use of UV cured inks on glass and ceramics is growing rapidly. The advantage of UV curing is that it uses far less energy than a lehr, the ink dries instantly. Adhesion can be very good if the glass is pre-treated and good if not. Claims that it is as resistant as fired enamels are optimistic but it is a real alternative for most applications. The colour range of organic pigments is greater than inorganic (fired on) whose colour vibrancy has been compromised by the necessary restriction in the use of heavy metals particularly lead.

When printing UV cured ink the method is the same as printing UV cured ink onto plastics and board. When printing inks that need to be heated to cure the ink film there are two ink systems that are used for this, one is cold printing and the other thermoplastic.

COLD PRINTING INKS (ENAMELS)

The term “cold” means that the ink is cold during printing. These inks (enamels) have oil based mediums that disperse the inorganic pigments, glass frit and additives in the liquid so that it can be printed through steel, polyester or nylon meshes. Nylon mesh would only be used if the surface to be printed on was profiled. The squeegee would also have to be shaped to follow the profile. Once printed the oils are burned off before the pigments and frit can be fired into the glass or ceramic. The whole cycle takes 1 to 1.5 hours. During that time the temperature is raised to between 600 to 650°C. The glass is held at that temperature for 10 minutes and then allowed to cool. The atmosphere of the lehr (kiln) should be oxidizing and well ventilated to get rid of the burned off residue of the medium. Controlling conditions in the lehr is a very important factor in achieving a satisfactory print. The disadvantage of the Cold Printing Inks (Enamels) is that in line multicolour printing is not practical as previously printed colours would be picked off by the screen. To allow multi-colour printing we use Thermoplastic Colour (TP). Heat cured organic inks can be applied using this method but they are not fired on but baked up to 200°C.

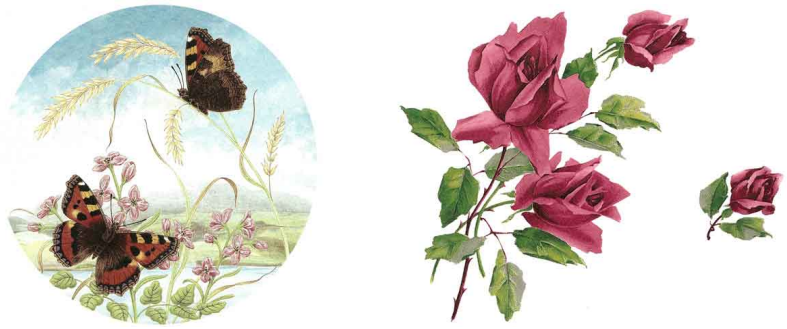
THERMOPLASTIC COLOUR (TP)

TP Inks are solid at room temperature and need heat applied to become printable. At temperatures below 50 °C TP Inks are a wax like solid. This has to first be pre-heated to up to 65-75^{o}C. The molten enamel is then poured into a heated metal screen. This can be heated either by passing a controlled electric current through the steel or by radiation with Infra Red lamps. The molten inks perform like conventional inks in their passage through the screen once the ink hits the colder glass it freezes and returns to its wax state. This means that no drying is required between each successive colour. TP’s are ideal for automatic multi-colour printing machines. Once printed onto the glass or ceramic the multi-colour image is fragile as it is only hardened wax that then has to be fired in the same way as cold colour. Multi-colour bottle printing lines will run at up to 9000 bottles per hour and print as many colours as you have printing stations.

The big advantage of any fired on inks or enamels are that they fuse to the glass or ceramic substrate and become part of the structure. Also metals can be used as pigments. Gold, silver, palladium, platinum can all be applied to glass and ceramics. The application can be for decorating or increasingly now as an electrically active film. The disadvantage is the complexity and cost of the lehrs that are normally gas fired.

If the need is to apply complex multi-colours onto an item the most effective method is to print onto transfer paper and apply either as a water slide or heat applied transfer the quality of the images produced in this way is second to none. Often up to 25 colours are used to create wonderful images that are then fired onto the glass or ceramic. Four colour process is also used for transfers and direct applications but the image must have a white background either as a printed raft or white substrate. Bailey Decals of Stoke on Trent are masters of the art.

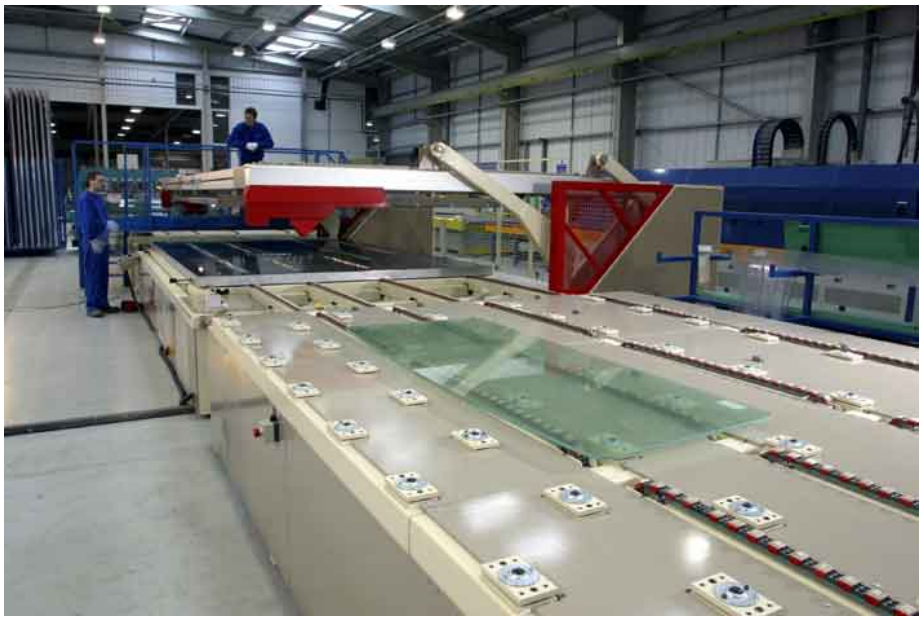
BAILEY DECALS STOKE ON TRENT



Automotive and electronics applications are also an important market for glass and ceramic printing. As the need for greater visibility from the driving seat increases so does the use of glass. Tones and filters have to be printed or electrical circuits such as heaters and antennae.

An area where this process is very popular is architectural glass. As buildings use more external glass screen printed effects are generating significant added value. Not just external glass but internal partitions with exotic designs can transform the working environment.

HG KIPPAX MACHINE PRINTING ON GLASS



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The photograph shown is of a continuous architectural glass Screen Printing Line. This line has a maximum print area of 3.65mts x 2.13mtrs the line is fitted with an automatic in feed section, printer, and automatic out feed section. It can also be fed from the front of the printer when using small format glass, the printer is fitted with the patented Thieme pneumatic squeegee assembly. The machine is operated from a Mac control panel which incorporates memory storage for all parameters of machine set up. H G Kippax has recently taken orders for this model of machine from Saudi Arabia, Canada, UK and India. HG Kippax demonstrate that you don't have to produce equipment in China to be successful when innovation, dedication, experience and a manufacturing facility in Huddersfield Yorkshire will do it for you.

At some juncture you may need to achieve a paradigm shift by bouncing ideas off team players to obtain granularity. By drilling down into detail you may raise the tide and re-float the boats of innovation. Have a nice day!

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