



The substrate is quite simply the surface that we print onto. It is not quite as simple as it sounds, because the range of substrates is constantly increasing. Last year we established the importance of a substrate being wettable by the ink. For those of you who have not run the gauntlet of information from these pages before the main characteristic that is required by a substrate to enable ink to stick to it is the level of its surface energy. The surface energy of the substrate must be higher than the surface tension of the ink. Both are measured in Dynes per Centimetre (dyn/cm.) If you want to go into this subject in detail find a quiet room take your laptop with access to the internet, a large flask of coffee and put many hours aside to do the research. It is extremely interesting because surface energy (for solids) and surface tension (for liquids) affect every aspect of life, as the basis of the science is the attractive forces between molecules and atoms. You will discover topics as diverse as waxing skis and constipation. The former is a cure latter if you wax your skis too well. From a printers perspective generally the substrate is determined by the client, what the printer has to do is decide on the ink and drying/curing system that suits that particular substrate and its working environment. Assuming the substrate ink combination will provide suitable adhesion then the printer still has considerable responsibility in ensuring that the partnership remains satisfactory. Maintaining the condition of the ink and its drying technique is crucial but so is managing the substrate.

Substrates can be divided into two basic groups those that absorb moisture and those that don't. Paper based products will normally be susceptible to moisture absorption whereas polymers (plastics) and metals are not. In all cases keeping the surface clean, free of contaminants and debris is critical to effective ink adhesion. Paper based products will deform if their moisture content changes unless they have been treated with materials that make it virtually impossible for ink to stick to them. Maintaining temperature and humidity of this material during storage and in the print shop is very important, also using as little heat as possible during the drying and curing process will keep distortion to a minimum. Plastics are also liable to change in size during drying and this can be an even greater problem when you combine paper and polymer in products like self adhesive vinyl, where the two materials expand and contract at different rates.

The effect of ambient conditions is key. These can be ideal but if the substrate is dirty then you run into a pile of other problems. Dust on the substrate will cause faults in the print that can be replicated throughout a run. Contamination as little a thumb print will stop the transfer of ink or compromise adhesion. The greatest hidden danger is to print onto a substrate that has not been allowed to reach the temperature of the print shop. An invisible film of water can form on the surface and act as a barrier to adhesion for the ink. It's happened to me and it was an expensive mistake. In this business, every day we discover a new way of screwing up.

Returning to the dust issue I have noticed that a particularly effective way of creating dust particles is the debris that can be produced when guillotining with a knife that has lost its edge. Easy to diagnose, just look at the slivers of material that can be found on the edge of a guillotined stack of material. Even without a magnifier carefully brushing

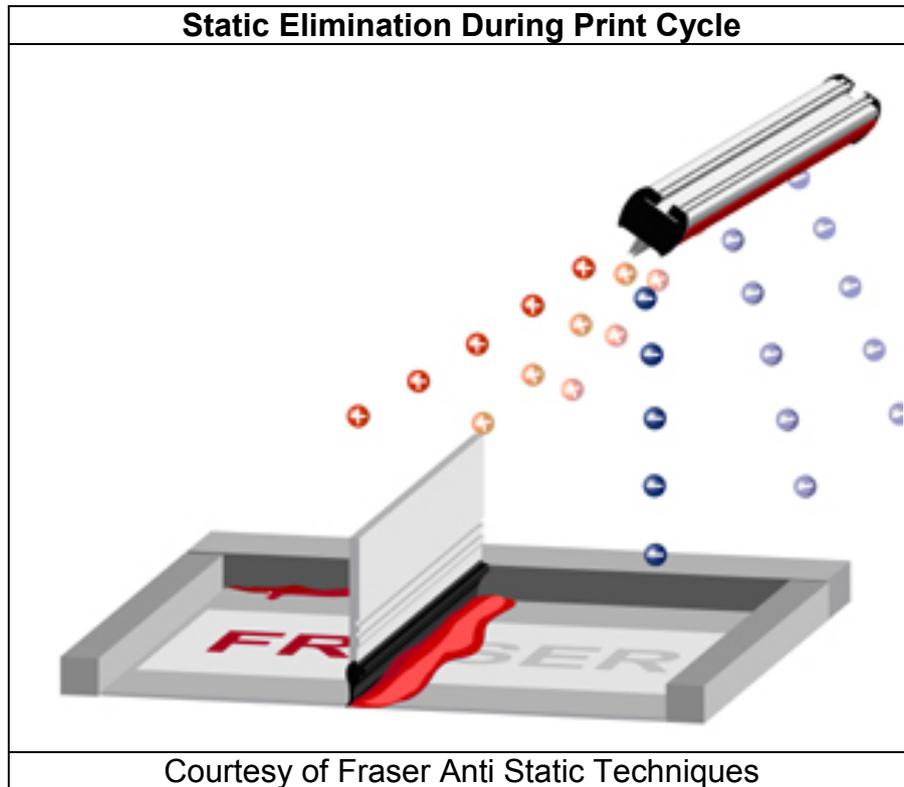
your finger across will demonstrate the issue. The same applies to any slitting or punching process the blades must be kept sharp.

Then we come onto the contentious issue of static electricity, some of the effects can be quite shocking! (The old ones are not the best. Ed.) Static electricity is created when electrically insulated materials are rubbed together, are heated and cooled quickly, cutting and slitting, being close to an electric field generated by static or subjected to high levels of Ultra Violet (UV) energy. Well that ticks all the boxes for printers! Particularly screen printers and digital printers to a lesser extent. So how do we deal with it? “In t’old days we ust t’boil t’kettle unter us print bed.” This worked to a degree because the steam humidified the air and created a route for the charge built up in the substrate and machine to leak away. Today we are much more sophisticated, and we have to be, because we create dry environments and work extensively with plastics both woven and none woven. Reducing the adverse effects of static electricity is a complex subject and there is not a one fits all solution.

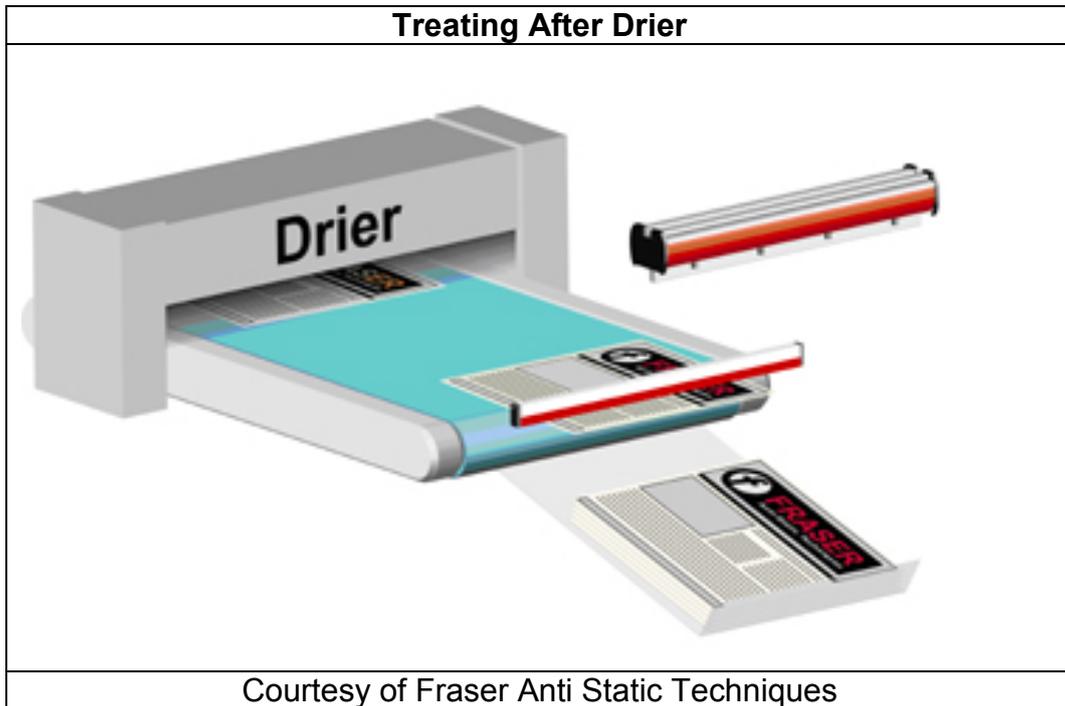
Before launching into some of the options for reducing static electricity it is worth considering some of the effects on the process.

- Incomplete transfer of ink
- Feathering on the edge of the printed image
- Substrate sticking during its passage through the machine
- Feeding of multiple sheets
- Substrate running out of line
- Attraction of dust and debris to the substrate
- Static discharge through the operator
- Explosion risk due to sparking
- Damage to electronic circuits

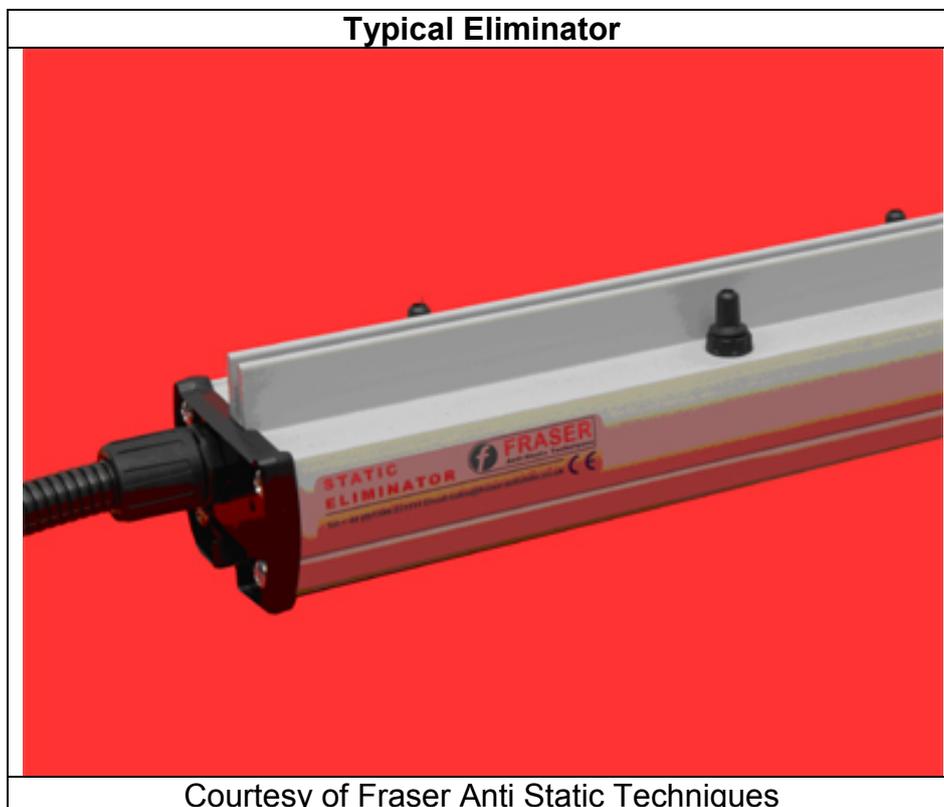
The aim has to be to stop the build up of static or neutralise it when it occurs. Stopping build up is about creating a route to earth for components and materials in which there is likely to be a build up of static electricity. When this is not possible it is necessary to have an effective means of neutralising static electricity. One of the experts in this field is Bob Fraser who with his company Fraser Anti-Static Techniques in Bampton Devon produces a wide range of devices to suit most applications. He stated that screen printing onto plastic substrates has always been affected by static electricity - whether dust attraction, ink misbehaviour or shocks to operators. Digital printing has inherited all of these problems - and because of the cost of inks and substrates static has an even bigger effect on the profitability of production. If you consider when digital printing you create millions of fine ink droplets that can easily be deflected by static charges.



In screen printing we are providing friction between the squeegee and mesh, the mesh and the substrate, between sheets of substrate, all the way through the process. During drying there is considerable temperature change and or fast moving dry air. All this builds up the amount of static electricity and finally at the exit to the drier there can be a stack of material that is alive with static. By positioning eliminators just before the stack this massive charge of static can be safely eliminated.



There is a wide range of reliable and safe products to overcome these static issues - such as Ionised Airguns for cleaning sheets before printing and various types of Static Eliminator Bars for neutralising static on the machine.





Even simpler solutions include tinsel like products that conduct the static charge away from the problem area. Static charges can build up to tens of thousands of volts with extremely damaging results particularly in potentially explosive areas. An explosive area is not always obvious. Clearly high levels of solvent fumes with low flash points are very hazardous but so are dry dusty areas. An aspect of screen printing that is often ignored as potentially hazardous is when grinding or finishing aluminium screen frames. If the conditions are right (which fortunately is very rare) the aluminium dust cloud produced can ignite by any spark or flame. If it occurs in an enclosed area an explosion may result. It is a rare occurrence but that is a danger in itself because we can become complacent and create a hazard.

Environmental issues are a key aspect of managing substrates, it has been known for a printer to waste at least 45% of the substrate purchased. By working efficiently, targeting zero defects, right first time and careful inventory control is better than any "Greenwash." Just look how much goes in the skip, calculate how much you paid for it in the first place, add on the overhead and labour plus wasted ink and then take an Aspirin and lay down in a darkened room.