

TECH PAPER

**THE SCIENCE OF KEEPING YOUR PRINT
CLEAN**

The science of keeping your print clean!

As in all stages of manufacturing, the adage ‘quality-in, quality-out’ applies to the printing, converting, and downstream processing of substrates in the package printing industry, and in this case the term ‘quality’ refers to the cleanliness of the moving web. In this paper we address the all-important issue, discuss the types of cleaning technology available, and explain how to achieve the best results.

Where it all begins

How clean is your web? If you were to examine it under a microscope you would be alarmed at the level and type of contamination that exists on rolls of material that you are using for packaging, especially where food products are involved. The contamination includes a variety of items from dust particles to strands of hair, but whatever it is, the impact of processing an ‘unclean’ web will be a reduction in quality of the end-product.

If the aim of all who work in this sector is to provide the customer with the best possible quality product, then the greater the care taken in preparation, the better the end-result will be. And this relates directly to the surface quality of the substrate and essentially explains how and why we, a company renowned for its surface treatment technology, first became involved in web cleaning.

Our business is built entirely on improving the surface quality of a range of non-absorbent substrates, and as such, we understand the importance of a clean surface for the further processing of these substrates. The cleaner the surface the more uniform its performance will be, so whatever the substance and size of particle, we know that all contaminants need to be removed to allow top quality print and processing.

Doing things in the right order

Ironically enough, our involvement with web cleaning stemmed from customer complaints that their corona treaters were not functioning properly. Closer inspection showed us that the fault lay not with the corona unit but with the cleanliness of the web being treated.

And the problem proved not to be a lack of web cleaning but the location of the unit in relation to the corona station. So, the first fundamental to take onboard is that **you should always clean the web before corona treating it**, otherwise you run the risk of reducing the dyne level with a residual silicone layer applied by the cleaner as shown in Fig 1.

Material Test				
Corona	Material factor applied			
	(W*min/m2)	Without web cleaning	Web cleaning after corona treatment	
Untreated	0	32	36	dyne/cm
	10	48	36	dyne/cm
	15	54	36	dyne/cm
	20	56	36	dyne/cm
	25	56	38	dyne/cm
	30	56	44	dyne/cm
	40	56	52	dyne/cm
	50	56	56	dyne/cm

Fig. 1 Material test – dyne levels with and without web cleaning (continued on page 2)

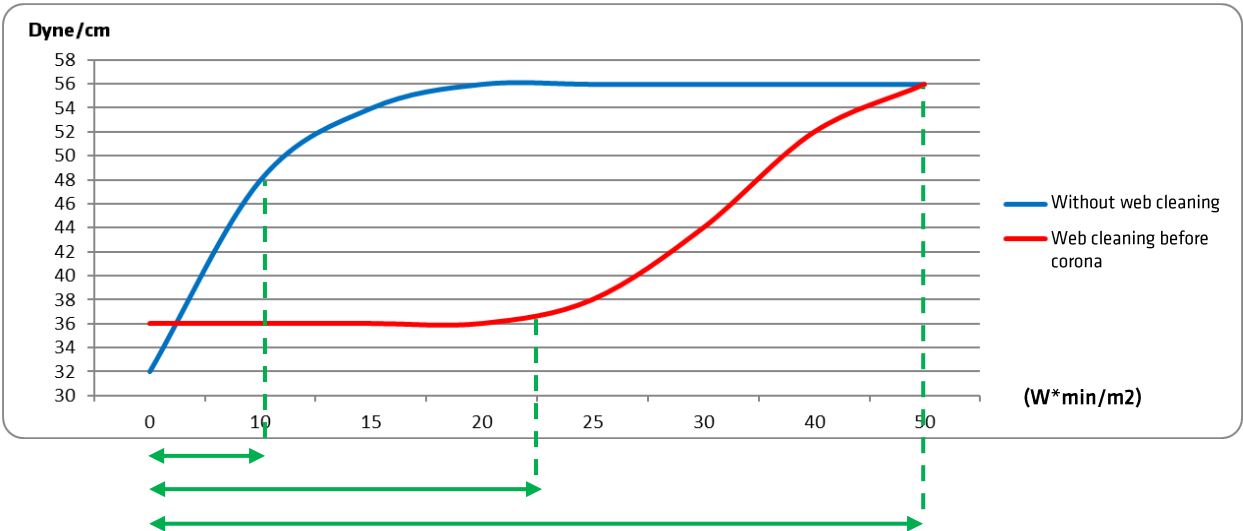


Fig. 1 Material test – dyne levels with and without web cleaning

By cleaning first, you achieve maximum effect from the corona station, and in many cases with a lower power requirement, and no reduction in production speed, both of which cost money. The difference is typically 4 dyne, but can be as much as 10 dyne, so remember, clean then treat as illustrated in Fig. 2

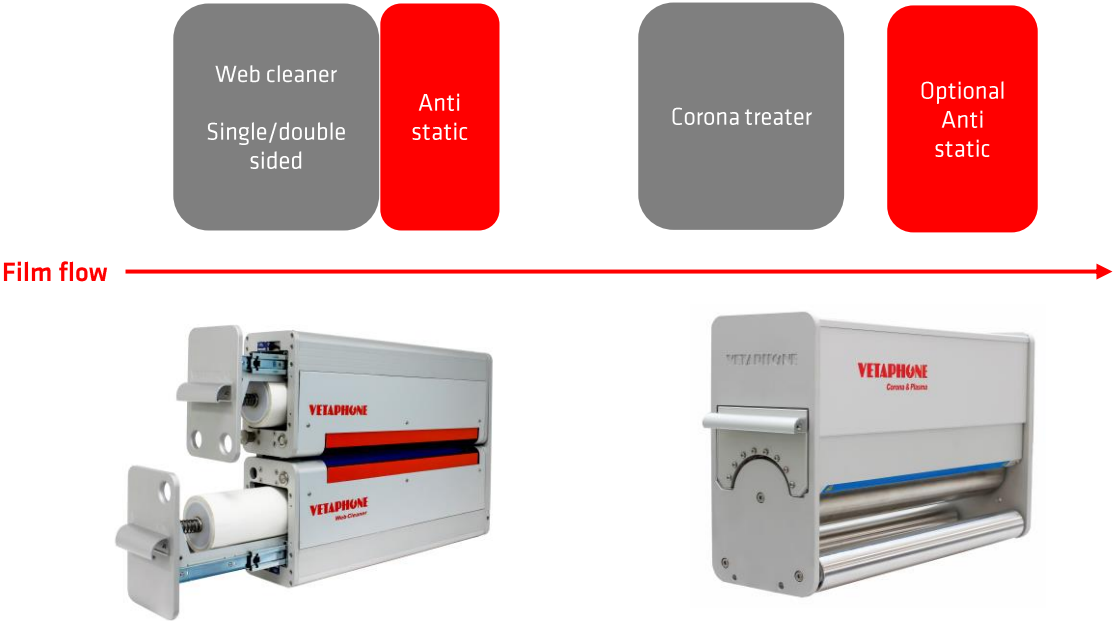
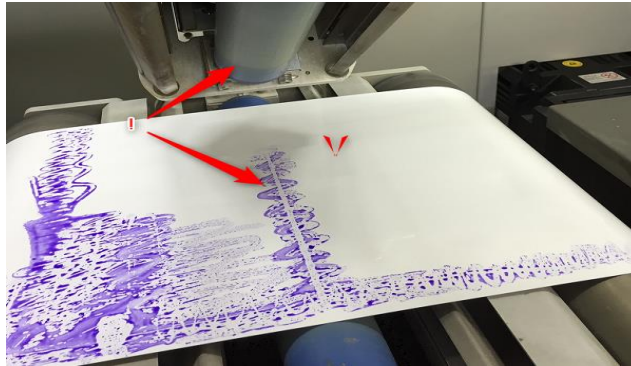


Fig. 2 The correct set-up for web cleaning and corona treatment

Proving the point

But knowing the end-result was only the beginning – what was important was finding the root cause of the problem and to understand this, we conducted a series of lab tests to research the issue. By taking a variety of the most popular elastomer (polymer or blue) and adhesive rollers in use and testing their effectiveness, we were able to identify the best and worst of combinations when the web is cleaned after being corona treated. In the worst case the effect was to completely remove the corona treatment, and the best case was a drop of only 2 dyne. But if the web was cleaned before being corona treated, there was an improvement of 2 dyne as shown below in Fig 3, so an overall difference of at least 4 dyne, and this can be preserved by use of an anti-static bar to prevent re-contamination.



Material factor: 10 W*min/m²

Corona

You get: 48 dyne/cm

Corona then web cleaner

You get: 46 dyne/cm

Web cleaner + corona

You get: 50 dyne/cm

4 dyne/cm in difference!

Fig. 3 Test of dyne level

The result of these tests was to prove that, for the majority of cases where Vetaphone customers need web cleaning, a contact system is best for film and foil substrates. This is not necessarily true for other materials. For example, paper, carton board, and tissue, are best cleaned with a non-contact or semi-contact vacuum system that is better suited to cope with the heavier levels of contamination and fibres associated with paper-based substrates. In these instances, the ionised air blown onto the substrate surface is sufficient to remove enough of the particulate contamination to allow an acceptable quality of further processing. With film and foil, this is simply not the case, because a higher degree of cleanliness is required.

The problem of contamination

What does not change is the main reason for cleaning the web and that is to maximise on the quality of the printed image. Who in the industry is not aware of the problem of small print imperfections, known as 'hickeys'? These are caused by contamination on the web of dry loose particles that transfer to the plate and subsequently distort the ink dot pattern that repeats through every printing station as illustrated in Fig 4.

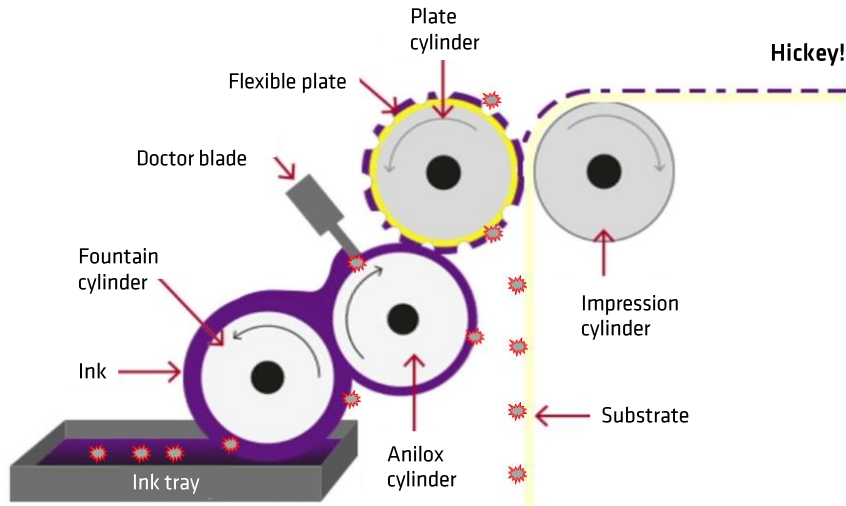


Fig. 4 Contamination transferred to the web

The result is a poor-quality image that is likely to be rejected by the customer and require a costly reprint, which with some of today's complex and expensive substrates is to be avoided. The simple solution is to clean the web prior to it entering the first print station.

So, how does the contact system work? It's based on well-proven technology that uses two polymer transfer rollers, sometimes called elastomer or blue rollers, manufactured from high quality material that allows a one-way transfer of particles. These slave-driven rollers, which are in contact with the moving web, transfer the particles onto the adhesive trap which then passes through an (optional) active or passive static elimination bar to prevent re-contamination – see the web cleaning system in Fig 5. The adhesive trap roll acts like a sponge in absorbing all the particles from the transfer rollers.

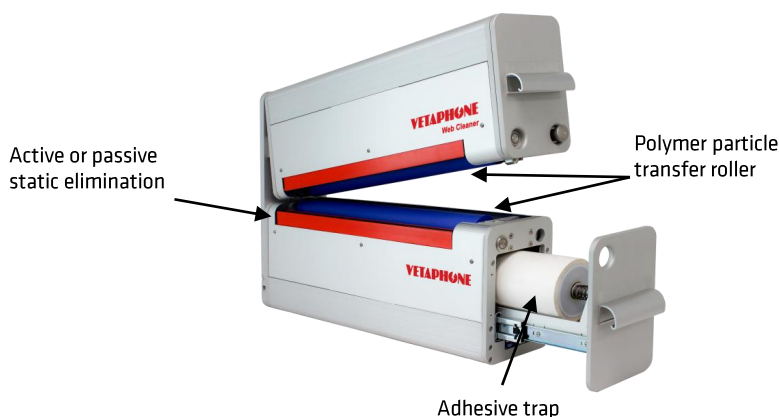


Fig. 5 Web cleaning system

Beware of percentages

A word of warning at this stage! Different manufacturers make various and sometimes exaggerated claims for the percentage of contamination their web cleaners are 'guaranteed' to remove. In truth, nobody can accurately assess this because there are too many variables, from transporting of the materials to its storage and subsequent use in the production environment, not to mention climate – no two situations are the same, and all that matters is that the web cleaner does a sufficiently good job to allow you to provide your customers with top-quality products.

Equally, however, it’s important to offer substantive proof that the system works, and to do this we commissioned Loughborough University in the UK to carry out a series of independently monitored tests. The test used dust particles that ranged for 0.7 to 80-micron from a PVC slitler as the contaminate and weighed the material before and after cleaning with our contact system. Over a series of four tests, the average of contaminate removal was 98.03% as shown in Fig 6 - but please remember, these tests were carried out under lab conditions not on a factory production floor.

	Test 1	Test 2	Test 3	Test 4	
Material weight uncontaminated	39.436	39.436	39.436	39.436	
Material weight contaminated	39.611	39.623	39.599	39.616	
Difference	0.175	0.187	0.163	0.180	
Material weight after cleaning	39.440	39.439	39.438	39.441	
Contamination removed	0.171	0.184	0.161	0.175	
	97.71 %	98.40 %	98.77 %	97.22 %	98.03 % average

Fig. 6 Contamination removal test carried out at Loughborough University (UK)

The simplest way of assessing the effectiveness of your web cleaner is to look at its adhesive roll, because whatever is trapped there would otherwise have gone through your production process with damaging results to quality.

Making best use of the technology

Having defined the best quality polymer and adhesive roller material, we set out to make the system more operator-friendly by combining control of the web cleaner with that of the corona treater. This includes an alert to the operator that the adhesive roll needs changing and has a pre-set that reflects the substrate being used and work being produced, both of which will affect the frequency of roll change.

The system also advises on service intervals and the need to clean the cleaner. The polymer roller should be cleaned regularly with IPA (iso propyl alcohol), but care should be taken to prevent any of the IPA dripping onto the adhesive roll because it will damage its ability to absorb contaminates, which will then pass through into the production process. Best practice is to remove the adhesive roll before cleaning the polymer roll. For heavy contamination on the polymer roll a lightly abrasive pad can be used in conjunction with the IPA but be careful not to damage the surface of the roller as this will result in flat spots and a subsequent drop in efficiency.

The adhesive roll also needs careful attention. Seen as a consumable, it is often purchased on price alone. But, as with most consumables, lowest price and best quality seldom go together. It's important to buy the best quality for the adhesive capability – if it requires changing more frequently it's because it's doing a good job of removing contamination that would otherwise pass into production – think about it!

To facilitate handling and improve efficiency, we have chosen to work with adhesive rolls that are perforated to allow easy detachment when the system indicates a change is required. These tear-off sections make for easy operation as well as offering a significant improvement in cleaning power. Conveniently, no knives or tools are required, so the change can be achieved quicker, and the tightly wound adhesive roll gives the extra stability needed to reduce contamination through flat spots where contact with the polymer roll is lost.

Usefully, the adhesive roll can be changed on the run, requiring only a 20 second disengagement activated by the operator – during this time the polymer roll remains in contact with the web and deposits the contaminants onto the adhesive roll once it is re-engaged. This can be done with both a single-sided and double-sided web cleaner – but our recommendation, even if you are only processing one side of the web, is to clean both – that way you can be sure that the maximum contamination is removed, and the web is as clean as possible.

A simple summary

As you can see, the principles are very simple and largely inexpensive – but the rewards are massive, and in some cases, incalculable. You just need to understand a few key points:

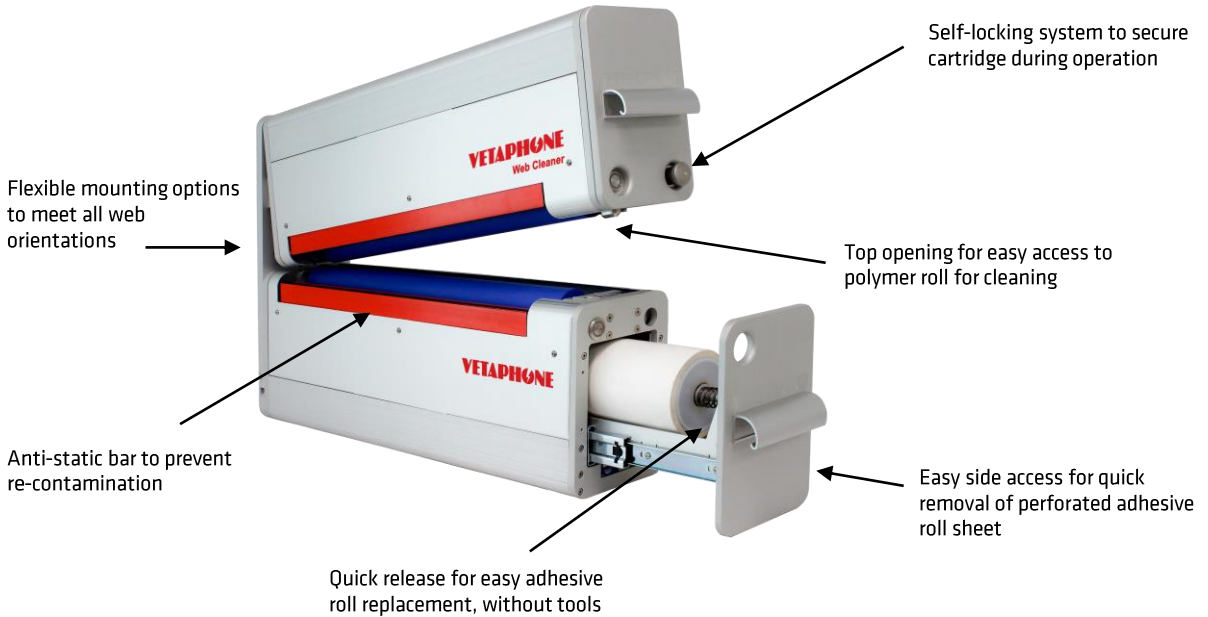
- ✓ Clean before surface treating
- ✓ Clean the web cleaner when it tells you to
- ✓ Cleaning both sides of the web gives the best results

Get it right and it's one variable that won't give you a production headache!

Vetaphone web cleaning

Our web cleaning technology is acknowledged for setting the industry standard because it is specifically designed to complement the performance and reliability of our corona treatment technology.

Features & benefits



Technical specifications (single or double sided web cleaner)

Widths:	350 -570 mm (13.8-22.4")
Speeds:	Up to 250 m/min (820 ft/min)
Power:	24V DC (0.5 A)
Active anti-static:	24V DC (1.5 A)
Pneumatic:	5-7 bar clean dry air

Want to know more? Scan the QR code below:



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