

Restoration Bicycle Decals for Dummies

A Technical Manual of bicycle decal history
and knowledge by: **SSSiNK.COM**

Classic and contemporary bicycles decals have been printed using the screen printing method for at least the past 150 years.

“Ink transfers” are the only method which allows inks to be printed independent of a carrier stock and then transferred to the bicycle frame. And only screen printing can produce these decals.

Modern, digital methods print the images on thick carrier stocks through the use of dyes. Vendors of carrier stocks, such Vinyl and Mylar, claim that they are producing materials as thin as possible, but these materials remain 4 to 5 times thicker than the decals of your bike’s original finish.

Digitally reproduced decals are, including their adhesives, over 1.5mils thick and, at a minimum, twice as thick as the original graphics. Using them is the equivalent of substituting a Shimano front hub on a Campy restoration and saying that it is close enough.

The following is an in-depth explanation of how these classic and modern decal/stickers are created.

Knowledge is so important for a true restoration and that includes the decals/stickers.

An Explanation of Bicycle Decal Types by SSSink

The internet is now swamped with companies selling the “best restoration decals” out there. Here is the difference.

What is a decal?

decal: noun

A picture or design transfer by decalcomania

decalcomania: noun

The process of transferring pictures or designs printed on specially prepared papers, to material such as glass or metal

What is a sticker?

Sticker: noun

1. One that sticks
2. An adhesive label or patch
3. A tenacious or persistent person
4. A prickle, thorn, or barb.

What is the difference?

Other than the fact that Webster’s Dictionary defines both as nouns, there are very few similarities.

Stickers are pieces of adhesive-backed material with a printed image that are used for decorating.

Decals are printed inks that are capable of being independently transferred for decoration.

Why choose decals over stickers?

Foremost, it is because of the thickness. If you are putting a sticker underneath of a clear coat, then the higher profile means that you or your painter will need to apply a much thicker clear coat in order to fully cover the stickers.

Second, the chemistry is important. SSSink’s ink transfers are designed to allow the clear coat to bond to the paint thru the decal. This makes the decal part of the finish. A Mylar or Vinyl becomes trapped under the clear coat and any bubbles or debris under the material will create a weak point in your clear coat.

Finally, SSSink uses only pigment-based inks that match any PMS color. Digital printing uses water-based dyes that transform the color of the material to a CMYK color. Our decals are more crisp, have a better vibrancy and are less likely to have color bleeding.

What is the downside to decals?

For digitally printed stickers, it's easy. Just click print.

Screen printing take more time and can be costly. There are set costs that are immaterial to the size of the decal or the quantity ordered. And what may seem like minor changes to size, color or design can reset the entire project to the beginning.

At SSSink, we make every effort to minimize the cost to restorers by pre-printing decals in our restoration catalogue and maintaining an extensive inventory.

Can Mylar or Vinyl stickers be better?

The answer is yes. Ink transfers are not suitable for all surfaces or finishes. SSSink has an extensive line of Digitally Cut Mylar and Vinyl decals for these purposes.

Screen printing comes with some limitations, especially when dealing with chrome or foil finishes. To produce restoration decals with these appearances, we may need to use a chrome Mylar as the base material.

And sometimes the original design of the decal requires it. Brushes titanium frames do not need a clear coat, so the original frame may have needed a Mylar decal.

In the event a Mylar or Vinyl is required, we will use the thinnest available material. This is typically a 1/2mil Mylar.

Why choose SSSink?

We have been producing decals for the bicycle industry since the 1970s and are committed to providing the most authentic graphics based on the original frame's design, finish and requirements.

Material Thickness

The Mil: A Very Important measurement

The accepted way to measure the thickness of something such as decals is to use Microns or Mils. Mils are based on the Imperial or US system of measurements while microns are based on the Metric System. Never should both units of measure be used together.

1mil is equal to 1/1000th of an inch. It is often confused with the Millimeter. In engineering circles that use the Metric System, it is referred to as a “thou” or “thousandth”
1 Micron is equal to 1/1000th of a Millimeter.

1mil is equal to 25.4 microns or .0254mm. 1 Micron is equal to .0000394 inches.

The most common materials SSSink uses are:

1/2mil Mylar - 1/2000th of an inch or 12.9 microns
1mil Mylar – 1/1000th of an inch or 25.4 microns
2mil Mylar – 1/500th of an inch or 50.8 microns

Adhesive Thickness

Manufacturers typically do not include the height of the adhesive when discussing the profile of a material.

The average thickness of pressure sensitive adhesives are 0.6mils or 15.25 microns.

What is an Ink Transfer?

Screen printing has been the primary print media for bicycle decals for over 100 years. And one particular style of screen printed decals has been the standard for the bicycle industry, the "printed ink transfer" or decalcomania.

There are several types of printed ink transfer decals but they all accomplish the same result. The stocks used in printing are used only for transferring the decal and are then discarded. **Only the printed ink transfer to the mounting surface.**

Eliminating the use of a carrier stock is the only way to achieve true decal thinness.

Types of Ink Transfers

The most common types of Ink Transfer are::

- Face Up Waterslide
- Face Up Waterslide with Strippable Clear
- Face Down Waterslide
- Varnish Fixed
- Solvent Fixed
- Pressure-Sensitive Dry Application

All ink transfers are different and require different methods of application. Samples are available upon request for practice and testing.

Face Up Waterslide Decals

Decal Edge - 1mil /25.4 microns thick

This is the oldest form of ink transfer decals. and most common in model car/boat/airplane kits we grew up on.

Face Up Waterslide Decals are generally printed on a blue decal paper with a positive image, meaning is appears on the paper as it is mounted.

The printed image is normally trapped between two layers of lacquer clears. The clear is typically shaped to join the individual pieces of the image in order to hold them in position as part of a single, transferable matrix.

The paper consists of the bond paper, which is tinted blue to aid in printing, that is then coated on the face side with a dextrose corn sugar layer. This corn sugar layer that prevents the printed ink from soaking into the paper while also working as the adhesive to hold the transfer down to the frame.

To mount these decals, simply dip the trimmed decal in water and then set on wet paper towel for approximately one minute. Once the decal can be freely moved on the paper, position the paper as close as possible to the mounting area. Then, gently slide the decal off of the paper and into position on the frame. Slide the decal into the final position as quickly as possible, to keep as much of the liquefied corn sugar behind the decal for better adhesion. The more you slide the decal around the less corn sugar remains behind the decal. Once in final position, carefully squeegee the decal down with very light pressure as to not squeegee more of the corn sugar out from behind the decal.

Advantages of a Face Up Waterslide Decal

This is the easiest type of decal for a novice to mount. However, with any increase in size comes an increase in difficulty.

You are able to digitally print on top of a screen printed lacquer. This will allow more intricate and complex designs at a decreases cost. The lacquer will cover the entire sheet, so you will need to closely and carefully cut apart the individual decals after the digital printing. It is key to not cut apart larger decals, like downtube decals with multiple letters, in order to ensure placement remains accurate.

Disadvantages of a Face Up Waterslide Decal

The nitrocellulose clear does will yellow over time, even after application. This problem was an accepted risk for generations of bike painters. Inside or outside. Under clear or over clear. The most drastic change will occur with more exposer to sun light with the decal turning to almost an amber at the edge. The introduction of acrylic clears has extended the shelf life, but at the extent of other factors. In order to prevent the decal from cracking during application, the acrylic clears, flexing agents are required. **These flexing agents will naturally migrate out of the decal and limit the shelf life to less than one year.**

The bonding of the decal is also an issue. The typical cure time of a waterslide decal is 30 days. The decals will become fingernail hard upon application, but the solvents in the inks rise to the surface and flash off over time, leaving the decal more delicate. This flash off is necessary to fully bond the underlying paint to the decal as opposed to the decal simply adhering to the surface of the frame.

With the new polyurethane paints and clears being used across the industry today, there is a molecular cross-linking that occurs between the paint and the clear coat. This blends the two into essentially a single layer. The problem is that this cross-linking does not account for the dextrose sugars in the decals that are used for adhesion. **The area around the decal becomes susceptible to chipping or separation when under pressure** (ie: when you strap the bike into a car rack, clamped into a work stand or even wrapped by packaging tape). Water can then seep into the clear coat and under the decal, resulting in the decal liquefying from the inside out.

Waterslides may the easiest decal to apply, but they are more suitable for a bike hanging in a studio as opposed to one that will need to undergo the daily wear and tear.

Face Up Waterslide Decals with Strippable Clear

Decal Edge - 0.4 mils / 10.16 microns thick

This is the decal most popular with present day bicycle production coming out of the Orient. It is printed face up style on standard decal paper. These decals are very thin at approximately 1/2mil once fully applied. These are super thin and excellent decals in a production setting.

The major difference from a standard waterslide decal is the printed clear is replaced by a removable or strippable clear. This will decrease the profile of the decal, but leaves the inks exposed and vulnerable.

To mount these decals simply dip the trimmed decal in water and then set on wet paper towel for about one minute. Once the decal can be freely moved on the paper, position the paper as close as possible to the mounting area. Then, gently slide the decal off of the paper and into position on the frame. This decal is very flexible and will wrap around compound surfaces. Squeegee down and allow to dry.

The major difference from a standard waterslide is in the post-application baking. The decal frame must be heated to 160-175 degrees Fahrenheit in order to accelerate the process of the adhesion and the solvent flash off. Upon complete on of the baking cycle, the strippable clear coat is then removed leaving just the individual components of the image on the frame. The decal frame is now ready for clear coating.

Advantages of a Face Up Waterslide Decal with Strippable Clear

Like the standard waterslide, this decal is quite easy to mount with a little practice. The big change will be learning the baking process.

This decal is also phenomenal for high-quantity production as long as you have a large-capacity oven to bake multiple frames at one.

Disadvantages of a Face Up Waterslide Decal with Strippable Clear

This decal is great for high-quantity production and...only high-quantity production. The typical shelf life of these decals is 3 months from the time of printing. That works for Specialized or Trek if they're producing hundreds of frames per week. However, the costs associated with setup and production are not conducive to small production or restoration.

SIDE NOTE: If you or your painter contact a major manufacturer for decals for a more modern frame, there's a good chance that you will have significant problems with application. You're not doing anything wrong. They just sent you decals that were about to expire from their stockpile.

Face Down Waterslide Decals on Duplex

Decal Edge - 1mil /25.4 microns thick

This decal has become very rare on the market and mostly comes out of the Orient, if available at all.
It is a decal printed face down with a water-soluble mounting clear.

The Duplex paper is no longer produced in favor of more versatile decal papers. SSSink does maintain one of the last supplies of Duplex in the world but very rarely uses it for current production.

Varnish Fixed Decals

Decal Edge – 0.6mils / 15.24 microns thick

After waterslides, varnish fixed decals are the oldest form of decals for bicycles. The paper that these decals are printed on is unique and consists of two layers. The base layer is a heavy backed paper onto which is a thin layer of tissue paper has been wet bonded. This layer of tissue paper is then coated with the dextrose gum solution. The decal is printed face down on the gum layer.

The old fashioned way to mount these decals is to apply a thin layer of varnish to the back of the printed image. When the varnish reaches tack, you pick at the corner of the paper and the tissue paper splits away from the backing paper. You then completely separate the decal and tissue paper from the backing paper and apply the decal to the frame. First you rub the decal down with your fingers, then squeegee it down with a burnishing tool. Then you wet the tissue paper with water, wait about 20 seconds and remove the tissue paper. Wash down the decal with water to remove the remaining dextrose gum solution. Last you take a soft lint free rag, just barely wet with mineral spirits, and remove any of the excess spar varnish from around the edges of the decal.

The modern way to mount these decals is with your polyurethane clear. Simply spray a very thin layer of your clear on the back of the decal, let the clear come to tack and mount. Follow the above steps to remove the tissue, water wash and you are ready to clear. There is no need to wash off the clear from around the edges of the decal, as the polyurethane doesn't yellow, and will blend in with your final clear coats.

Advantages of a Varnish Fixed Decals

This is the “classic” method for mounting decals.

Disadvantages of a Varnish Fixed Decal

This decal also used Duplex paper, which is no longer being produced. Print shops that continue to produce these decals (including SSSink) maintain ample supplies, but there is no longer a resupply source. At some point, these decals will become unavailable.

This is one of the trickier decals to apply due to the separation of layers. It will take a lot of practice to finely tune your applications skills.

Solvent Fix Decals

Decal Edge – 0.7mils / 17.78 microns thick

Solvent fixed decals have become a very popular method of decorating. The image is printed between layers of slightly larger clears that transfer the inks to the mounting surface. Through use of a solvent application solution, the decal bonds to the surface through a controlled re-melting.

The mounting solution used a butyl cellusolve mixed with water. A typical starting solution is 8-parts water to 1-part butyl and the butyl can be increased for a “hotter burn” into contaminated surfaces like powder coats. The water dissolves the dextrose corn sugar layer that the decal is printed on, while the butyl remelts the final clear layer of the printed decal the bond the decal to the frame.

After dipping the decal into the solution, you have 15-20 seconds to slide it into position. Once the decal is in position, wait approximately 1 minute to allow the solution to fully release the decal from the paper. Re-wetting the paper using a mist spray is recommended to decrease surface tension before sliding the mounting paper away. Wash off remaining dextrose solution, and allow to dry.

Advantages of a Solvent Fixed Decals

This is the most common form of mounting printed ink transfers and requires no baking to achieve an excellent bond. Baking can be used to accelerate the curing process, especially when clear coating over them.

This decal can easily be removed if mounted incorrectly. Because of the longer curing time, you can lay packing tape on top and remove with a quick pull. This will not harm the underlying paint.

This decal uses the most common decal materials available and does not require an active adhesive, making it the most cost effective ink transfer.

By increasing the solution strength, this decal can mount to almost any painted or powder coated surface.

Individual letters are not connected by the clear, as is the case with waterslides. And because the clears extend less than 1/2mm from the image, any yellow over time is not visible.

Disadvantages of a Solvent Fixed Decals

The main disadvantage is the need for the solvent solution. The butyl needs to be purchased from a third party. Butyl also has a tendency to evaporate very quickly if not in a sealed container.

If the decal is not allowed to cure for 48-72 hours before a clear coat is applied (or baked to accelerate the process, solvent trapped under the clear will bubble during the final baking.

All traces of the dextrose sugar must be removed before baking or will crystalize to an amber color on light colored frames.

Pressure Sensitive Dry Application

Decal Edge – .8 mils thick/ 20.32 microns, including the adhesive

This decal has been the standard of American handmade bicycle industry for the past 30 years. It is a variation of the Varnish Fixed decal. Instead of applying a varnish to the back of the decal, we print a pressure sensitive adhesive. The printed pressure sensitive adhesive adds 0.1mil to the printed image.

To apply, you first removed a silicone sheet that protects the adhesive from drying out. The decal is printed on a clear film that is removed from its carrier stock. Burnishing the decal through the films causes it to release and adhere to the frame. A clear coat can be applied immediately after application.

Advantages of a Pressure Sensitive Dry Application Decal

This decal has been considered the gold standard of bicycle decals for the last 30 years. It does not require any special tools or mounting solutions and gives the closest appearance to a painted design.

This type of decal is available in 2 types:

Clearcoatable Dry Application (CCDryAP) is designed for being cleared over with almost all wet paint systems. The formulation of the decal allows the clear coat to bond through the decal and to the underlying paints to bound the decal fully as part of the finish.

Top Mount Dry Application (TMDryAP) is designed for top mount applications, including bare titanium.

Disadvantages of a Pressure Sensitive Dry Application Decal

If applied incorrectly, these decals can be difficult to remove, especially from a painted surface. Because of the acrylic inks and clears, acetone is the recommended method of removal.

Pressure Sensitive Mylar and Vinyl Decals

THESE STYLES OF DECALS/STICKERS ARE NOT INK TRANSFERS. THEY ARE BY DEFINITION: STICKERS

Pressure sensitive stocks used in the production of stickers come from two families, Mylar and Vinyl. Inks are then printed on the various stocks, coated with a protective laminate (if necessary) and are then digitally cut to the closest degree as possibly around the image.

Mylar/Polyester stocks are thinner, cheaper and more durable. However, they can only be wrapped around a single curve, such as a bicycle tube.

Vinyl stocks are thicker, more expensive and less durable but can be wrapped around a compound curved surface. Care must be taken when mounting on compound curves as the vinyl materials can only be stretched, but not condensed. The printing of vinyl decals used to be only done by the screen printing method, but in the last 10 years digital printing has pretty much taken over the market.

Digital printing can only be used on vinyl stocks.

Generally speaking, these “stickers” are almost impossible to apply improperly. The sheer thickness of the material allows for them to be applied, peeled up and, in some cases, reapplied.

Please remember that clear coats cannot bond to the underlying paint through Mylar or Vinyl. If there is a bubble under the stock once applied, that will be the weak point of your clear.

Mylar Decals

Polyester is the generic name for the Mylar. These films are typically available in 1mil, 2mil, or 4mil thicknesses. Because thinner is better in the bicycle industry, custom 1/2mil stocks can be produced.

Again, the thickness of the Mylar does not include the adhesive or the profile of any protective laminate. Normal adhesives run 0.6mils thick but the aggressive outdoor adhesives can sometime be 1mil thick. And laminates will add another 1mil to 1.5mils to the profile. A decal using 1mil Mylar is actually 2.6mils to 3.5mils thick once complete.

Clear is the most commonly used Mylar, but they are also available in white and chrome. Unlike Vinyl, there is not a wide range of base colors and we rely on printing in order to meet the requirements of the design.

Polyester stocks can either be screen printed or color sublimated, but never digitally printed. Digital printing uses water-based dyes that are absorbed into the stock. Polyester-based stocks cannot absorb the dyes. Since the inks are printed on the surface, the decals are laminated to protect the inks.

Following lamination, the Mylar is digitally cut to the shape of the design. We strive to keep the digital cuts equivalent to a 2-point outline (approximately 1/2mm) around the image to include individual letters or pieces, if possible.

An application tape in the final layer. This allows you to apply the decal without handling the adhesive and to apply the individually cut components together.

Vinyl Decals

Vinyl films are normally available in 2mil Cast Vinyl or 3mil and 4mil Calendered Vinyl. Calendered Vinyl is sometimes referred to as “bumper sticker” stock and, while cheaper, is not suitable for decaling. It will have a tendency to shrink over time, even if applied underneath of a clear coat.

The same rule about adhesives and laminates applies with Vinyl. A 2mil Vinyl will be upwards of 4mils thick once complete. If you are planning on clearing over the vinyl decals, we can eliminate the laminate and print an acrylic clear that will protect the inks until the clear coat is applied as well as enable to the clear coat to better bond with the decal.

If you are using a digital printer who is using clear stock, ensure that he is printing a white backup behind the colors. On darker color frames with lighter graphics, the underlying paint can change the printed colors is not properly backed up.

Under no circumstances should you purchase Vinyl sticker that have been printed on a white vinyl. With the vinyl being 2mils thick, there is no way to print completely through or around the edge of the stock. Once digitally cut, there will be a white edge to the sticker that will be visible even under a clear coat.

In Conclusion

If you are restoring your vintage frame to its original beauty, thinner is better, and screen printing ink only transfers are the correct medium.

Two coats of clear will bury an ink transfer to the point of having no edge showing.

Your original decals were screen printed transfers, which is an old-school technology. Modern stickers are typically digitally printed and these technologies rely on thick stocks to carry the printed/digital rendered image.

Screen printed transfers use acrylic inks, meaning the transfer is as if you are painting the graphics on by hand. Digital printing is the use of pixelated dots to form colors and the image will often appear blurry or pixelated upon closer inspection.

Stickers will never live up to your expectations or to the original look of your frame. Only an ink transfer can replicate your bike's old finish.

Why look to future technologies when you're restoring an old classic?

INK ONLY TRANSFER DECALS / Vintage & Production Decalcomania.

Face up Waterslide transfer
decals on most currently made
Oental production frames

12 micron second clear coat
12 micron first clear coat
15 micron-.5mil decal thickness
12micron base paint color



Face up Waterslide transfer digitally
printed over a full coverage screen
printed clear layer on decal paper
using the dextrose sugar as the only
bonding agent. Must be scissor cut

12 micron second clear coat
12 micron first clear coat
3 micron-.1mil digital image
10 micron-.3mil base clear thickness
1 micron-..001mil dextrose sugar
12micron base paint color



Face down solvent fix transfer
decals

12 micron second clear coat
12 micron first clear coat
15 micron-.5mil decal thickness
12micron base paint color



Screen Specialty Shop's
CCDryAP face down
ink transfer decals.

12 micron second clear coat
12 micron first clear coat
15 micron-1/5mil decal thickness
3 micro-1/10mil adhesive thickness
12 micron base paint color



Vintage Waterslide
decal transfer
Not recommended due
to bonding issues

12 micron second clear coat
12 micron first clear coat
30 micron-1 mil decal thickness
12 micron base paint color



PRINTED STICKERS(not decalcomania) on "Thick" carrier stocks

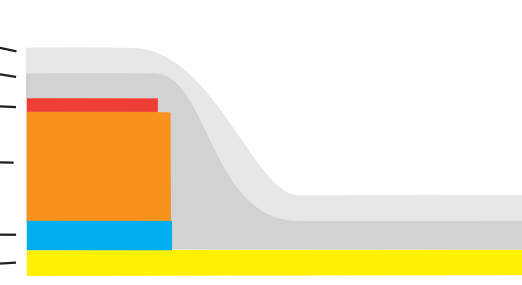
Standard 1mil/minus adhesive
face up cut Mylar-Polyester
surface . Can be over laminated.

12 micron second clear coat
12 micron first clear coat
4 micron decal colors
30 micron-1 mil clear stock thickness
15 micron decal adhesive thickness
12 micron base paint color



Standard 2mil/minus adhesive
face up cut cast Vinyl
surface printed.
Screen or Digitally printed.
Can be over laminated.

12 micron second clear coat
12 micron first clear coat
4 micron decal colors
60 micron-2mil clear stock thickness
15 micron .6mil adhesive thickness
12 micron base paint color



Standard 2mil/minus adhesive
face up cut cast Vinyl
surface printed.
Screen or Digitally printed.
Over laminated for durability.
Used in vehicle graphics.

12 micron second clear coat
12 micron first clear coat
30 micron-1 mil over laminating
stock thickness
10 micron over laminating
adhesive thickness
4 micron decal colors
60 micron-2mil clear stock thickness
15 micron .6mil adhesive thickness
12 micron base paint color

